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EASTERN SLOPES PREHISTORY: SELECTED PAPERS

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Brian Ronaghan
EDITOR

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EASTERN SLOPES PREHISTORY:
SELECTED PAPERS

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Brian Ronaghan

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INTRODUCTION

By

Brian Ronaghan
Archaeological Survey of Alberta

To those living in other parts of Canada or continental North America, the term Eastern Slopes may not be a familiar one. To those living in the shadow of the Rocky Mountains, it is much more than a simple geographical term. From the Continental Divide eastward to the interior plain, the great diversity and physical beauty of this country has long attracted both the traveller and the resident. It also has been attractive to prehistoric native groups over the millenia for a wide variety of reasons, beyond those of aesthetics. Archaeological studies seeking to understand the characteristics of the prehistory of this area are the subject of this volume.

This is the first in a proposed series of regionally oriented collections to be compiled by the Archaeological Survey of Alberta. When initially conceived, they were intended to supplement our other mechanisms for publication by bringing together important previously unpublished work, presenting the preliminary findings of on-going studies, and by drawing the whole into a unified perspective on the archaeology of the region in question. In many ways, the contributions contained herein fulfill these goals, but the highly diverse nature of the offerings testifies to the broad range of interests and research directions which characterizes archaeological study in Alberta's Eastern Slopes. Rather than providing a unified perspective on a region where archaeology is in its adolescence, we are left with as many questions as answers.

The papers are organized in a geographical cline from south to north, with those having a more region-wide perspective being retained for the latter portions of the volume. Although considerably greater numbers of studies have been conducted in the southern half of the region, this volume contains a roughly equal number of papers based on data generated north of the Bow River valley. In some cases, these constitute the first published record of that work.

The inclusion of papers which present largely the data generated by field work and draw limited regional interpretation might be criticized; however, in many areas, there is simply no substantive comparative information available. As editor I accept responsibility for these inclusions but offer no apologies because it is my feeling that there is considerable value in the dissemination of preliminary information on areas where limited knowledge exists.

I would like to express my sincere gratitude to the contributors for taking time from their busy schedules to write and review the papers presented here, as well as for their patience in accepting the numerous delays. I hope that the contributions in this volume will be useful as reference material to researchers in the area and that future study will effectively grapple with some of the issues raised by these papers.

I also wish to thank a number of colleagues at the Archaeological Survey for their indispensable assistance in the preparation of this volume. Wendy Johnson drafted original figures for the in-house contributions and modified those for external submissions. Lois Schneider typed and retyped drafts, and both Martina Purdon and Gabriella Prager provided extensive, valuable editorial assistance. Their efforts have greatly improved this volume and for this I am extremely grateful. Nevertheless, any errors or omissions are soley my responsibility.

A LOCATIONAL AND SUBSISTENCE ANALYSIS OF PELICAN LAKE PHASE SITES IN CROWSNEST PASS, ALBERTA

By
P.G. Duke
Department of Anthropology
Fort Lewis College

INTRODUCTION

Studies over the past decade have indicated that the Crowsnest Pass (Figure 1) is an area of prime archaeological significance, due to both its excellent resource and habitation potential and its function as a major communication corridor between the Plains and the Intermontane areas to the west. Archaeological work during this period has been both mitigation- and research-oriented (see, for example, Driver 1978; Reeves 1974a, 1974b). Fortunately, coordination of these different types of study by one person (Reeves) has meant a synthetic and unified approach to all archaeological work in the pass. The result is that the Crowsnest Pass is one of the better understood areas in the southern Canadian Rockies.

The purpose of this paper is to summarize the results of a locational analysis of sites assigned to the Pelican Lake Phase of the Middle Prehistoric Period (Duke 1978). This analysis was designed to examine the factors determining the location of sites in the area and to develop certain hypotheses regarding prehistoric subsistence and settlement in the southern Canadian Rockies.

THE NATURAL SETTING

Crowsnest Pass is an east/west-oriented valley connecting the Plains in the east to the Intermontane areas to the west (Figure 1). The rise in altitude along the pass, 30 km in length, is from 1195 m at the east end to 1360 m at the west end. The pass transects a number of separate north/south trending ranges. Most important of these archaeologically is

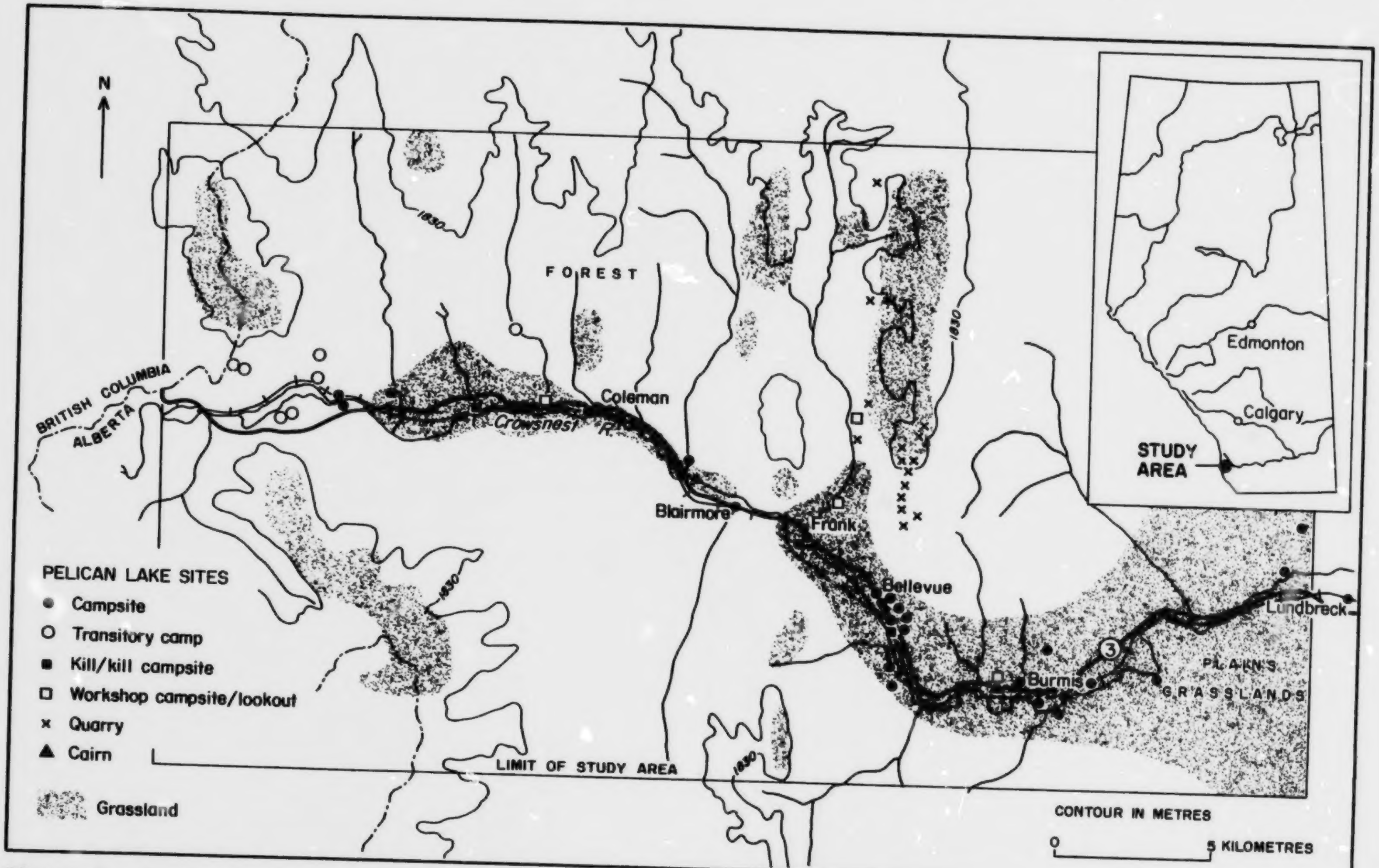
N
FOREST
BRITISH COLUMBIA
ALBERTA
Crowsnest R.
Coleman
Blairmore
Frank
Bellevue
Burmis
③
Lundbreck
PLAINS GRASSLANDS
1830
LIMIT OF STUDY AREA
Edmonton
Calgary
STUDY AREA
PELICAN LAKE SITES
● Campsite
○ Transitory camp
■ Kill/kill campsite
□ Workshop campsite/lookout
× Quarry
▲ Cairn
Grassland
CONTOUR IN METRES
0
5 KILOMETRES

Figure 1. Crowsnest Pass study area.

the most easterly, the Livingstone Range, since it contains Etherington chert, a major component of lithic assemblages in the Pelican Lake Phase.

Palaeoenvironmental studies by Driver (1978) have shown that there has been little change in the basic floral and faunal communities in the pass during the Holocene. Although there were some Neoglacial advances during the Pelican Lake Period, it appears that these were not of such magnitude as to have made the ecology of the pass vastly different from that of today (Driver 1978; Duke 1978).

The Euro-Canadian settlement of the area has resulted in some changes to the general environment. In particular, the decrease in natural fires has resulted in a decrease in valley grassland; mining activities have altered some of the topography of the middle valley; and, most noticeably, the large ungulate herds have been greatly reduced or, as in the case of the bison, eliminated completely. Apart from these modifications, however, the environment of the pass has remained essentially unchanged since the prehistoric period.

Crowsnest Pass lies within the Northern Cool Temperate Zone (Longley 1967a); however, it exhibits extreme climatic variability (Table 1), the result of both localized conditions such as frost hollows (Longley 1976b) and the sporadic influence of the Pacific Maritime air system. In

Table 1. Monthly and annual mean temperatures (in °C) for 1976 and standard 1941-1970 average (from Environment Canada records).

	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Fort Macleod	-3	-2	-1	7	13	13	18	17	15	6	1	-1	7
	-9	-5	-2	6	11	15	19	18	13	8	0	-5	6
Lethbridge	-4	-2	-2	7	13	13	18	18	15	6	1	-3	7
	-9	-6	-2	6	11	15	9	8	3	8	1	-6	4
Pincher Creek	-4	-3	-2	6	11	11	17	16	14	6	1	-2	6
	-9	-5	-3	3	9	13	17	16	11	6	-1	-6	4
Coleman	-4	-4	-4	4	9	10	14	14	12	4	-1	-2	4
	-8	-6	-3	2	7	11	14	13	9	5	-2	-6	3

1976 values - top line
1941-1970 values - bottom line

winter, this system creates Chinooks which regularly break through the dominant Polar Continental system and can increase the temperature of the eastern part of the pass by as much as 20°C in less than 24 hours (Longley 1967b).

Precipitation shows similar variability (Table 2). Generally, annual precipitation values decrease as one goes east, resulting in more frequent drought conditions at the east end of the pass.

The vegetation of the pass is dominated by grasslands, the most common of which is Festuca scabrella. This type of grass is especially valuable to ungulates because it produces a large amount of highly palatable food, retains its nutritive properties through the winter, and greens up relatively early in the spring (U.S. Department of Agriculture 1937). Much of this grassland is found in the valley bottom, with some extending into the larger side valleys. True Alpine meadow is limited to the very highest reaches of the surrounding area and is little more than a Krumbholtz-type extension of the upper forest reaches.

Forest is found all along the valley sides and is mainly a sub-Alpine association interspersed with small stands of montane. The dominant species of the sub-Alpine community are lodgepole pine (Pinus contorta) and various spruces, particularly Engelmann (Picea engelmannii). Montane forest is defined by the presence of Douglas fir (Pseudotsuga menziesii) and is found predominantly on the south-facing slopes where drier conditions prevail. Small bush and arboreal species are also found along the main valley bottoms. These include both coniferous and deciduous species such as willow and alder. Throughout the various forest stands are numerous plants, including saskatoon berry, chokecherry and huckleberry, used historically by native groups such as the Kootenai (Hellson and Gadd 1974; Turney-High 1941).

Aquatic zones in the pass include lakes, streams and marshes. The major lake in the pass is Crowsnest Lake at the extreme western end. The major aquifer is Crowsnest River which is fed by a number of smaller tributaries. Marshes and wetlands are found sporadically along the valley bottom.

Historically, the major ungulate in the pass was the bison. The following model for bison ecology in the pass (Duke 1978) is based on studies of herds in Yellowstone (McHugh 1958), as well as on historical

Table 2. Monthly and annual total precipitation (in cm) for 1976 plus standard 1941-1970 values (from Environment Canada records).

	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Fort Macleod	0.94	1.8	1.1	2.2	5.1	9.5	3.3	11.2	1.6	1.1	2.1	1.27	41.8
	2.0	2.3	2.5	3.2	6.0	9.8	4.0	4.2	4.0	1.9	1.9	2.1	44.0
Lethbridge	1.1	0.8	1.1	2.8	4.0	7.5	4.9	6.5	1.3	1.1	1.4	0.9	33.3
	2.3	2.2	2.6	3.6	5.1	9.0	4.5	3.9	3.7	2.3	2.3	2.1	43.6
Pincher Creek	2.1	3.0	1.2	2.3	5.1	8.6	5.0	13.6	3.4	0.8	2.2	2.6	50.0
	3.3	3.2	2.7	5.3	7.0	10.0	3.4	4.4	5.7	3.5	2.8	2.8	54.1
Coleman	3.5	7.2	1.4	1.27	3.9	3.6	4.2	21.7	2.0	3.0	2.4	1.4	55.6
	4.7	3.5	2.8	4.5	6.2	7.2	3.4	4.8	4.3	3.6	4.7	4.1	53.7

1976 values - top line
1941-1970 values - bottom line

evidence (Roe 1951). During summer, bison would have been found throughout the pass. With the approach of winter, the herds would have moved down into the valley bottoms where there was more shelter and less snow cover. The extreme east end of the pass would have served as a primary wintering area, since the Chinooks kept temperatures higher and exposed grasses more regularly. This Chinook belt probably would have served as wintering ground for not only small groups of bison moving from the west but also larger groups coming off the open plains.

Other ungulates in the pass included elk, mountain sheep, mule deer, and possibly moose (Driver 1978). Other fauna comprised bear, carnivores, various rodents and fur-bearing animals such as beaver, muskrat and hare. A number of resident bird species, migratory waterfowl and lake and stream fish were also available for use as food.

THE CULTURAL SETTING

A comprehensive overview of Crowsnest Pass culture history by Driver (1978) has revealed an unbroken record of occupation since at least 10,000 years B.P. There seems to have been little variation in subsistence patterns during the prehistoric period. The palaeoeconomy apparently revolved around the heavy utilization of bison, supplemented by exploitation of a wide range of ungulate, plant, fish and small animal species, at least in the western end of the pass (Driver 1978; Duke 1978).

The Pelican Lake Phase occupation of the pass comprises 51 sites representing various sizes and functions. It is distinguished by the distinctive Pelican Lake Corner Notched point, found in association with other characteristic artifact forms (Reeves 1983). This phase, found throughout the Northern Plains and adjacent mountains, is dated to between 3000 years B.P. and 1800/1600 years B.P. and is part of the Tunaxa tradition (Reeves 1983). Subsistence strategies identified with Pelican Lake sites range from wide-spectrum hunting, fishing and gathering in the west (Turnbull 1973) to communal bison hunting on the Plains (Reeves 1983).

THEORETICAL AND METHODOLOGICAL CONSIDERATIONS

An understanding of the factors underlying the location of archaeological sites must be based on a number of assumptions regarding the role of the natural environment and the organization of subsistence strategies. In this study, the following assumptions have been made:

- The locations of archaeological sites are determined by the needs of the overall subsistence strategy of which the sites are but a part.
- The sites are non-randomly distributed over the landscape, based on the seasonal and regional availability of resources. Site use will be scheduled to take advantage of seasonal availability.
- Sites will be located with the view of minimizing the effort required to exploit the requisite resources.
- The precise location of a site can vary within reasonable limits without impairing the efficient and economical exploitation of resources from that site. Factors determining such precise locations are termed "microlocational."

Modelling locational strategies and, by implication, subsistence strategies are a necessary first step in understanding prehistoric cultural dynamics. Models ideally provide the most powerful characterization of complex prehistoric phenomena. They eradicate "noise" and thus offer a simplified version of the actual complex relationships between the numerous variables involved in locational and subsistence strategies. Finally, they provide a framework for the incorporation of new data into our understanding of the past by their ability to be modified and to generate new hypotheses.

This study developed models for understanding the locations of Pelican Lake Phase sites in the Crowsnest Pass at two distinct, albeit interrelated, levels. The first level examines the specific factors determining site location within the pass itself. Here sites are viewed in terms of how they represent exploitation of particular resources and their articulation into overall settlement and subsistence strategies. No precise contemporaneity of site use can be assumed because these sites are part of a seasonally adapted subsistence strategy; therefore, it does not seem reasonable to model the sites into "territorial lattices" (Clarke 1968:507) such as those based on Theissen Polygons or Central

Place Theory. It should still be possible, however, to identify the place of each site within an overall settlement and subsistence system and to demonstrate the integration of the sites with each other and with exploited resources.

The second level of analysis expands the focus of attention beyond the pass to the wider regional setting. This level examines how human groups who utilized the pass may have used adjacent areas and how the pass itself may have been integrated into a wide-ranging subsistence strategy.

LOCATIONAL ANALYSIS

SITE SAMPLE

A total of 51 sites or site components were assigned to the Pelican Lake Phase, based primarily on the presence of Pelican Lake Corner Notched points. Although the quarry sites at the east end of the pass did not contain points, they were also assigned to the phase on the basis of the high frequencies of their distinctive raw material, Etherington Chert, in Pelican Lake components in the pass.

The following site classification was based on function, which was inferred from the types of cultural behaviour evidenced by different tool types (Driver 1978; Reeves 1974a, 1974b). Other criteria for inferring function included such factors as presence of vantage points and location relative to east-west communication routes.

Campsites (n=22) are defined by the presence of a wide range of functional tool types, fire-broken rock, butchered bone, living floors and/or tipi rings. These suggest use as a base camp or a centre for a variety of cultural activities.

Kill sites (n=1) are defined by the presence of specific bone butchering patterns and a location suitable for bison killing.

Kill/campsites (n=2) include those sites which contain evidence for both kill and campsite functions.

Workshop/campsites (n=2) are recognized by the presence of the previously noted evidence for campsite function as well as an association with lithic processing.

Workshop/lookout (n=1) is classified by evidence of tool manufacture and good vantage point overlooking the valley.

Quarries (n=15) are sources of lithic material associated with evidence for the primary removal and processing of stone nodules. Their assignation to the Pelican Lake Phase is based on the high concentration of the specific sources in Pelican Lake components.

Transitory camps (n=7) are very small, short occupation sites located on major communication routes. They contain very little cultural material.

The cairn class (n=1) consists of a single stone cairn possibly used for burial or for other as yet unknown functions.

Specific locational data for the sites were obtained by on-site inspection during the summer of 1977 (Table 3). It should be noted that determination of priority of the various locational factors is based on simple frequency of occurrence. For instance, a southerly aspect occurred more frequently than did a northerly one; therefore, it was concluded that the former was more often selected than the latter.

LEVEL I ANALYSIS

The pass can be divided very roughly into three major resource units. The upper valley consists of Crowsnest Lake and adjacent areas, containing a variety of exploitable resources such as ungulates, small mammals and birds. The bison probably summered in this area. The middle valley ranges from east of the upper valley to the edge of the Chinook belt. The lower valley, located east of the Livingstones, is where large winter concentrations of bison would have been found. The upper and lower valley sections represent the foci of exploitation during the summer and winter, respectively.

In the upper valley, major campsites, such as DjPp-3 and 8, were occupied during the summer and early autumn (Driver 1978). These sites are located on an ecotone where the valley grasslands, forest zone, alpine areas and aquatic habitats could all be economically exploited. This ease of exploitation is reflected in the wide variety of animal bones recovered from these sites: bison, elk, deer, sheep, beaver, muskrat, bear, canid, felid, hare, bird and fish. Although bison were

Table 3. Site classification and location.

SITE	CLASS	MAJOR LOCATION	SUBSISTENCE	MAJOR MICROLOCATIONAL FEATURES
DjPn- 9	Campsite	Grasslands	Bison	S. exposure, shelter, water, fuel, drainage
14	Campsite	Grasslands		S. exposure, shelter, water
15	Campsite	Grasslands		S. exposure, water, drainage
16	Campsite	Grasslands		S. exposure, shelter, water
46	Campsite	Grasslands		S. exposure, shelter, water
62	Campsite	Grasslands	Bison	S. exposure, shelter, water, fuel
66	Campsite	Grasslands		S. exposure, shelter, water, fuel
102	Campsite	Grasslands		S. exposure, water
DjPo- 10	Campsite	Grasslands		S. exposure, "edge"
25	Campsite	Grasslands		S. exposure, shelter, "edge", water, fuel
44	Campsite	Grasslands		"edge", drainage
45	Campsite	Grasslands		"edge", water, drainage
46	Campsite	Grasslands	Bison	S. exposure, "edge", vantage
66	Campsite	Grasslands		S. exposure, drainage
75	Campsite	Grasslands		S. exposure, shelter
79	Campsite	Grasslands		S. exposure, "edge", drainage
81	Campsite	Grasslands		S. exposure, shelter, vantage, "edge"
84	Campsite	Grasslands		S. exposure, shelter, vantage, "edge", water
85	Campsite	Grasslands		S. exposure, shelter, vantage, "edge", water
88	Campsite	Grasslands		S. exposure, shelter, vantage
DjPp- 3	Campsite	Ecotone	Wide-spectrum	S. exposure, shelter, major ecotone
DjPp- 8	Campsite	Ecotone	Wide-spectrum	S. exposure, shelter, major ecotone
DjPo- 9	Kill/campsite	Ecotone	Bison	marsh, shelter
DjPp- 15	Kill/campsite	Ecotone	Bison	marsh
DjPo- 2	Workshop/campsite	Forest		quarries of Livingstone Range
102	Workshop/campsite	Forest		quarries of Livingstone Range
DjPp- 35	Workshop/lookout	Forest		vantage
DjPp- 5	Kill site	Forest	Bison	edge of outwash plain
DjPo- 62	Quarry			Etherington chert source
71	Quarry			Etherington chert source

Table 3 continued

SITE	CLASS	MAJOR LOCATION	SUBSISTENCE	MAJOR MICROLOCATIONAL FEATURES
DjPo- 72	Quarry			Etherington chert source
110	Quarry			Etherington chert source
128	Quarry			Etherington chert source
137	Quarry			Etherington chert source
138	Quarry			Etherington chert source
139	Quarry			Etherington chert source
140	Quarry			Etherington chert source
141	Quarry			Etherington chert source
142	Quarry			Etherington chert source
143	Quarry			Etherington chert source
DkPo- 14	Quarry			Etherington chert source
15	Quarry			Etherington chert source
DjPo-126	Quarry			Etherington chert source
DjPp- 2	Transitory	Grasslands/ forest/lake	Bison	S. exposure, shelter, ecotone
12	Transitory	Forest/ grassland		S. exposure, shelter
29	Transitory	Sheep range	Sheep(?)	water
30	Transitory	Sheep range	Sheep	water
37	Transitory	Phillipps Pass		water
56	Transitory	Phillips Pass		water
57	Transitory	Grasslands/ forest		
DjPn- 8	Cairn	Grasslands		edge of terrace

still the most numerous, the exploitation of these other species was more than a minor occurrence.

Transitory camps appear to be restricted to the west end of the valley, away from the valley grasslands. These sites may represent the movement of people through the pass or the exploitation of other animals besides bison. For example, sites DjPp-29 and 30 are well located to exploit the sheep ranges which still exist south of Crowsnest Lake, and, indeed, sheep bones were tentatively identified at DjPp-30.

During the summer months, the various plant resources undoubtedly would have been exploited. As has already been noted, these were used for a number of purposes besides food (Hellson and Gadd 1974; Turney-High 1941), and, while plant collection probably did not affect the overall structuring of subsistence patterns, their importance should not be overlooked.

Human groups probably wintered mainly in the lower valley where Chinook conditions would have resulted in a more amenable climate and would have attracted large gatherings of bison. At two excavated campsites in the lower valley, DjPn-9 and 62, the reliance on bison is seen in the overwhelming preponderance of their bones in the assemblages. No kills have been found in the area, but it is possible that the animals were taken in snowdrifts, as documented ethnohistorically (see McHugh 1972).

However, these two main seasonal foci of exploitation do not represent the entire subsistence spectrum. Also of importance are the exploitation possibilities of the middle valley, demonstrated by the analysis of site DjPo-46. According to the faunal evidence (Duke 1978), this site was occupied in autumn-early winter and/or late winter-spring, and subsistence was based almost exclusively on bison. The site overlooks the valley constriction just east of Blairmore, and it is well situated to take the bison as they passed through this constriction. Furthermore, the site is well situated for easy access to the Etherington chert deposits, and there is evidence that this chert was processed at the site. DjPo-46, therefore, seems to have combined food procurement activities with other resource exploitation.

While site location within the pass was generally determined by subsistence needs, precise location was determined by "microlocational" factors. These included specific environmental factors such as shelter, slope, aspect and drainage (Table 3).

Sites DjPp-3 and 8 are located so as to economically exploit a number of different resources. Further to the east, the location of campsites at the edges of the grasslands is an interesting locational phenomenon. Presumably, this location minimized interference with the natural movements of the bison through the grasslands. These sites include DjPo-10, 44 and 45 and the cluster of sites around Bellevue.

Another important consideration in bison hunting is vantage. Site DjPp-35 is a small site classified as a workshop/lookout. The site would have provided an excellent view of bison moving about in the valley below. The viewing potential of site DjPo-46 has already been noted.

At the east end of the pass, needs such as water and fuel primarily influenced site microlocation. The lower valley campsites are all located close to water, either the Crowsnest River, a tributary creek or a local spring. Proximity to the main drainage would have brought the additional advantage of fuel obtainable from the localized stands of timber along the river.

Besides subsistence factors, the main recurring environmental feature affecting microlocation was exposure. Of the 51 sites analyzed, only two, DjPo-44 and 45, are not on south-facing valley slopes or in a situation where solar radiation is at a maximum. Such an aspect had the advantages of more rapid snow melt, drier ground and, thus, preference by ungulates.

The need for shelter is also a recurring factor in microlocation, since the prevailing westerlies can be extremely strong, even in summer. Both DjPp-3 and 8 in the upper valley are protected by high bedrock ridges. Selection for shelter is also evident at lower valley sites. For example, DjPn-14, 46 and 62 lie immediately east of a bedrock ridge. DjPn-9 is afforded protection by the outwash plain and nearby trees.

One other factor to be considered in campsite microlocation is the drainage. Sites are located on terraces (e.g., DjPn-9) or alluvial fans (e.g., DjPo-25), particularly at the east end of the pass. Both kinds of location offer good drainage. However, because terraces form a major part of the total land area, particularly at the east end of the pass, this may not have been a major factor in selecting a site location.

The microlocations of most of the other analyzed sites are related primarily to their specific functions. The transitory camps, for example, are optimally located for hunting purposes (e.g., DjPp-29, 30) or in close proximity to major transportation routes (e.g., DjPp-2). Similarly, all the quarries and workshops are located at or near lithic resources.

The limited sample of kill sites does not allow for much discussion. All three sites are small-scale kills, probably due to the small size of bison herds in the pass and the use of small, natural physiographic features. At DjPp-5, the single event kill probably occurred by driving a small group of bison over the edge of the outwash plain. At sites DjPo-9 and DjPp-15, bison were likely driven into a marshy area where they could be dispatched. Both DjPp-5 and 15 are located in the centre of large, formerly grassy, outwash plains west of Coleman, where bison would have gathered during the summer. It can be inferred that these latter two sites were of short-term use; camps of a more permanent nature presumably would not have been located right in the middle of the prime bison grazing area. Using only this level of analysis, it is possible to construct the following model of an annual subsistence pattern in the Crowsnest Pass.

Human groups spent the entire year in the Crowsnest Pass, summering in the west end and moving to the east end for the winter, en route perhaps spending a period of time utilizing the Livingstone quarries. This hypothesis is attractive for its simplicity. Certainly, seasonal movements of the ungulate populations would sustain such a cycle, since mountain-adapted bison would be the main prey in the summer, and plains bison would be exploited in the winter. Also, the evidence for seasonality of site occupation supports this cycle: summer in the upper valley; early winter in the middle valley; winter in the lower valley; late winter/spring in the middle valley. If such is the case, the presence of exotic lithics would be best explained by the existence of a well-developed set of exchange networks. However, such a model is only one, obvious explanation of the available data. To examine other possible explanations, it is necessary to place the Crowsnest Pass within its wider regional setting.

LEVEL II ANALYSIS

It is highly unlikely that the Crowsnest Pass was a closed system with yearly subsistence strategies practised entirely within its boundaries. Ethnographic evidence alone demonstrates that the pass was seasonally utilized by people who spent the rest of the year elsewhere. The following model may be put forward, based on ethnographic evidence.

People who spent the summer at the west end of the Crowsnest Pass wintered to the west of the Continental Divide. The cycle is similar to that of the historic Kootenai who seasonally came over the Continental Divide to hunt bison (Turney-High 1941). Evidence for prehistoric contact between these two areas includes the presence of Trench lithics, such as Kootenay argillite or Top of the World chert, in Pelican Lake Phase sites; the latter is the most frequent exotic lithic at DjPp-8, for instance (Driver 1978). Sites at the east end of the pass were occupied by groups who came in from the open plains to escape the severity of the winters. These people would not have penetrated the mountain range much beyond the foothills. Such a pattern for plains groups has been documented elsewhere, both prehistorically and historically (Wedel 1963; Quigg 1974; Graspointner 1977).

A second model can also be generated from an examination of the differential use of lithic sources in the southern Canadian Rockies during the Pelican Lake Phase (see Reeves 1972, 1983). For instance, the Mountain variant of Pelican Lake, the Blue Slate Canyon subphase (first defined by Reeves [1972] in the Waterton Lakes area), differs from the Mortlach subphase to the east in the presence of flake points and the amount of exotic lithics. In the former subphase, fifty percent of all stone tools are made from Central Montana cherts. This contrasts with a frequency of only two percent for those cherts at the Head-Smashed-In site, fifty kilometres east of the Crowsnest Pass. Kootenai argillite is present in Head-Smashed-In but absent from Waterton Lakes sites.

In these models, the Crowsnest Pass served as only one resource area used by human groups engaged in a widely ranging pattern of movements throughout the southern Canadian Rockies and adjacent areas, both east and west. Such a generalized movement pattern, perhaps over a number of years, would explain the widespread, patterned distribution of lithic types throughout the region.

Unfortunately, it is extremely difficult at this time to choose which model, or combination of models, most economically fits the actual prehistoric situation. A major reason behind the difficulty is simply that the prehistoric record presently lacks the resolution necessary for identifying individual "ethnic" or "social" groups (see Duke 1981). In addition, methodologies must be developed to help isolate prehistoric exchange and trade networks as a means of explaining some of the observed homogeneity and heterogeneity of cultural assemblages throughout the southern Canadian Rockies.

CONCLUDING STATEMENT

This paper has attempted to explain the distribution of archaeological sites in the Crowsnest Pass, southern Alberta, during the Pelican Lake Phase. Assuming that site locations were primarily determined by overall subsistence strategies, sites were examined to see how they contributed to the fulfillment of subsistence goals. At the same time, however, it was argued that a number of "microlocational" factors determined the precise location of sites. Such factors were related not only to subsistence needs but also to such features as slope, aspect and drainage.

The analysis of locational and subsistence strategies was conducted at two distinct levels. The first viewed the pass as a "closed system," while the second considered it as only one resource area within a much more widely ranging seasonal round. Three distinct models were developed from these analyses. It is concluded here that their testing will most profitably be done within a wider regional subsistence analysis that considers the Crowsnest Pass as a facet of more general prehistoric subsistence and settlement patterns in the southern Canadian Rockies.

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ORGANIZING EASTERN SLOPES PREHISTORY:
A SUGGESTED METHOD

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INTRODUCTION

The Eastern Slopes, which span the North American continent, have frequently been treated as a distinct archaeological area. However, little attempt has been made to define the boundaries precisely, often making it difficult to determine what specific area is under discussion. Similarly, there has been a failure to recognize the natural variation inherent in this zone as a factor influencing the nature of prehistoric occupations and exploitation strategies. As a result, the Eastern Slopes begin to exude a pan-cultural character.

DELIMITATION OF THE EASTERN SLOPES

It is recommended that the Continental Divide be recognized as the western boundary of the Eastern Slopes and that the eastern boundary be defined by the eastern limits of the Foothills Ecosystem. Along their length, the Eastern Slopes constitute a transition zone between the Rocky Mountains to the west and the plains to the east.

DATA COLLECTION UNITS

Straddling the contact between the mountains and the plains, a great range in environmental diversity is exhibited from the extreme northern to the extreme southern limits of the Eastern Slopes. As an organizational tool for investigating the north-south variation inherent in the Eastern Slopes, it is recommended that data collection units be established. The data collection units must be acceptable and recognizable to investigators as a method of ordering data for comparison. Because prehistoric occupation foci were integrally related to water bodies, it is recommended that collection of information on prehistoric occupations be based on major drainage systems. Upper river drainage systems, separated from lower river drainage systems by the eastern margin of the Foothills Ecosystem, naturally section the Eastern Slopes along the north-south axis. These units, termed regions, constitute ideal collection units for studying past human responses to varying local environments resulting from changes in latitude. Due to natural gradation in environments, contiguous units hypothetically exhibit greater similarity in cultural responses than units more widely separated. Similarities in cultural responses as reflected in the archaeological record should consequently be visible in quantifiably distinct patterns in artifact and subsistence-settlement attributes. Use of data collection units is necessary for systematically assessing internal north-south variations and relationships in Eastern Slopes prehistory and for formulating relationships between the Eastern Slopes and adjacent regions.

In the Eastern Slopes, five regions were identified on the basis of major drainage basins: the Upper Oldman, Upper Bow, Upper North Saskatchewan, Upper Athabasca and Upper Smoky River basins (Figure 2). The number of regions can be extended both northward and southward of the Alberta borders by similar division of the Eastern Slopes. Sub-areas are defined archaeologically on the basis of similarities in cultural content found within the defined regions. Analysis of sub-area is used to isolate similarities in adaptations, epitomizing particular lifestyles which reflect the north-south variation in the environments of the Eastern Slopes. Sub-basins (e.g., the Elbow and Sheep basins in the Upper Bow basin) form smaller collection units, termed subregions, and are used for studying adaptations to micro-environments. Areas of intensive occupation occurring in restricted geographical areas within the subregions are termed localities and are used for determining criteria for prehistoric selection of preferred occupation locales. The smallest unit of data collection is the site.

The proposed model permits comparison between areas, regions, subregions and localities. In addition, this model can be used in conjunction with models from other disciplines, such as Strahler's (1957) "Stream Order Designation," to provide valuable intra-regional comparisons.

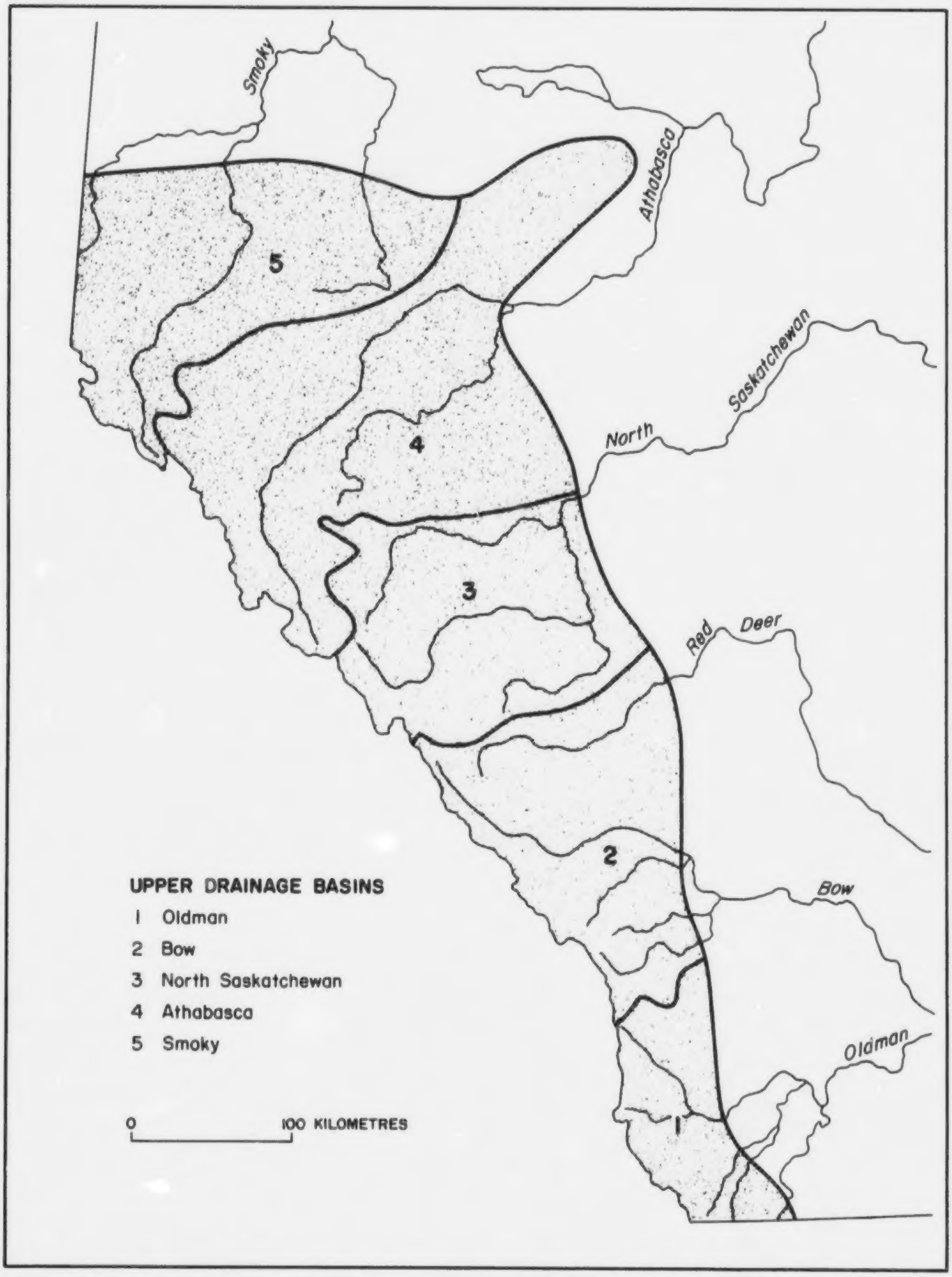
Smoky
Athabasca
North Saskatchewan
Red Deer
Bow
Oldman
5
4
3
2
1
UPPER DRAINAGE BASINS
1 Oldman
2 Bow
3 North Saskatchewan
4 Athabasca
5 Smoky
0
100 KILOMETRES

Figure 2. Major upper drainage basins along the Eastern Slopes.

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BANFF ARCHAEOLOGY 1983-1985

By

Daryl Fedje

Parks Canada, Western Region

INTRODUCTION

The Archaeology Research Unit of Parks Canada, Western Region has recently excavated several deeply stratified prehistoric sites in the Bow River valley west of Banff townsite, Alberta (Fedje 1985, 1986, n.d.; Fedje and White 1984, 1986; Robinson 1986). Prior to the 1980s, no well-stratified sites had been excavated in the park. The impetus for the recent work was an increased level of development, including reconstruction of the Trans-Canada Highway and other, less substantial terrain-altering projects. The combined record from excavations associated with these developments allows interpretation of cultural activities extending to ca. 10,500 years B.P. The present report will briefly document elements of this record deriving from the Vermilion Lakes site, the Christensen site, the Second Lake site, and the Echo Creek site.

THE VERMILION LAKES SITE

The Vermilion Lakes site (Fedje and White 1984, 1986) occupies a debris-flow fan on the north side of the Bow River valley a few kilometres west of Banff townsite (Figures 3 and 4). Field programmes sponsored by Public Works Canada were conducted in 1983 and 1984 in response to the proposed reconstruction of the Trans-Canada Highway. The highway was later redesigned so as not to conflict with this significant prehistoric resource. The site is deeply stratified with a record extending from historic times to ca. 10,500 years B.P.; however, only the deeply buried cultural layers exhibit good context. This is largely the result of rapid sediment build-up prior to ca. 9,000 years B.P. as opposed to gradual aggradation after this time. A minimum of thirteen occupations are present including seven which are well stratified. Most

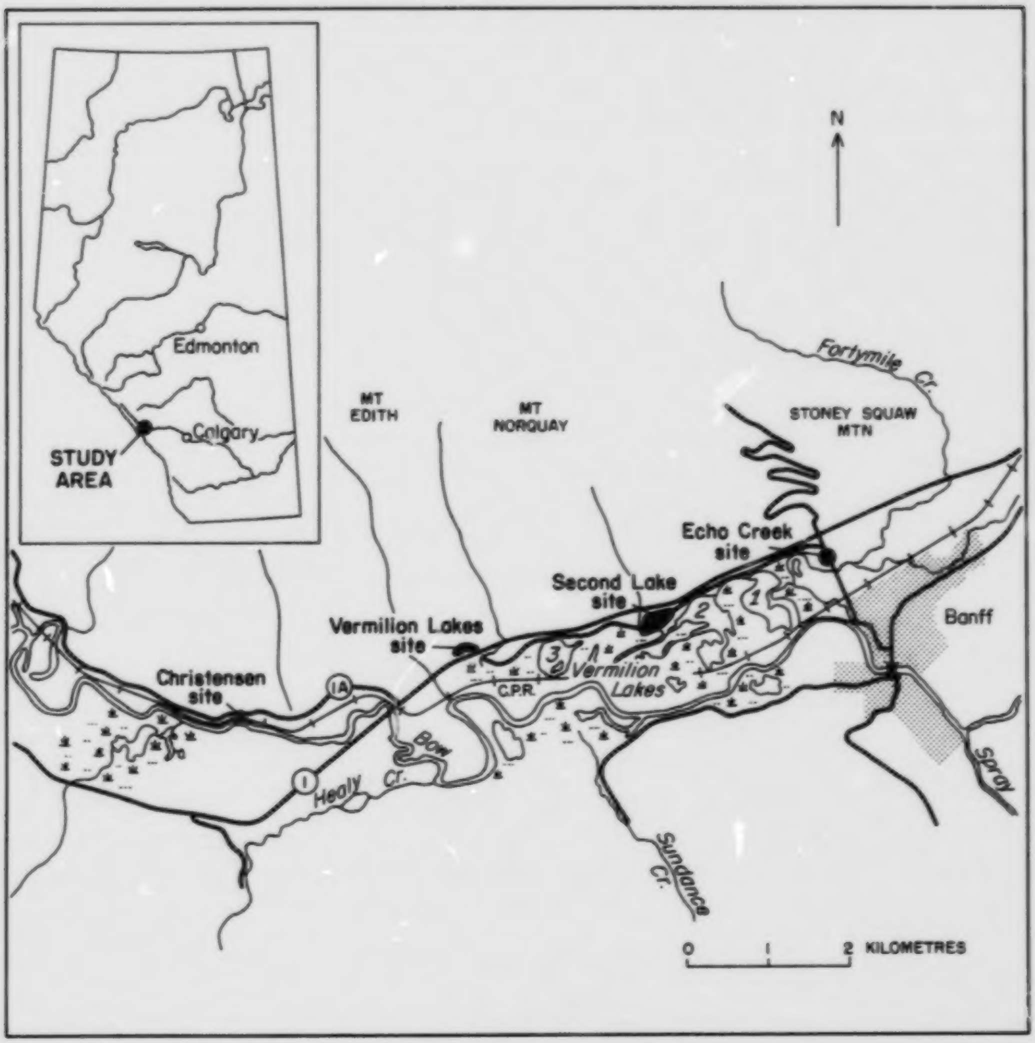

Edmonton
Calgary
STUDY AREA
N
MT EDITH
MT NORQUAY
STONEY SQUAW MTN
Fortymile Cr.
Echo Creek site
Second Lake site
Vermilion Lakes site
Christensen site
1A
1
2
3
C.P.R.
Vermilion Lakes
Bow
Healy Cr.
Banff
Spray
Sundance Cr.
0 1 2 KILOMETRES

Figure 3. Bow valley study area.

activity at the site appears to have occurred ca. 10,000 ± 200 years B.P., and recovered data point to several discrete short-term occupations.

LOCALITY A

Stratigraphy

Although site stratigraphy at Locality A (153R, Figure 4) is complex in terms of the numbers of depositional events and correlation between discrete excavation units, for the most part, it does provide excellent vertical separation of occupation layers. Processes responsible for

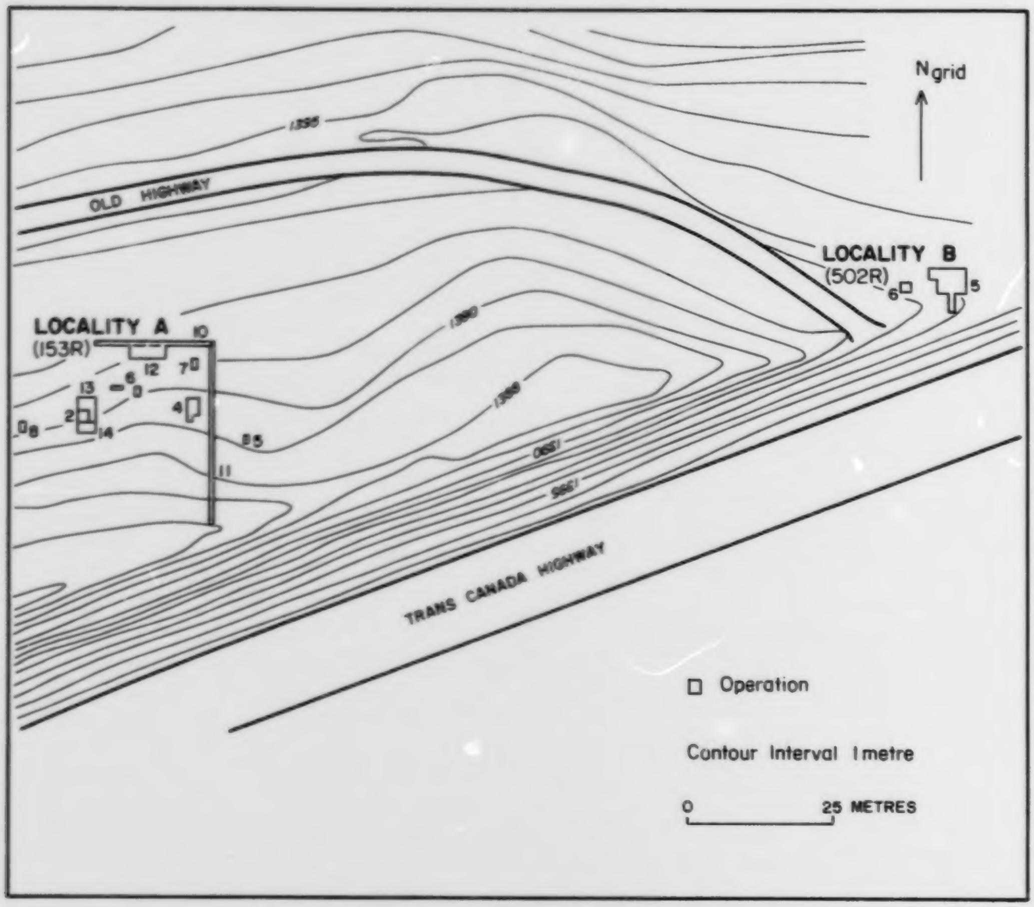
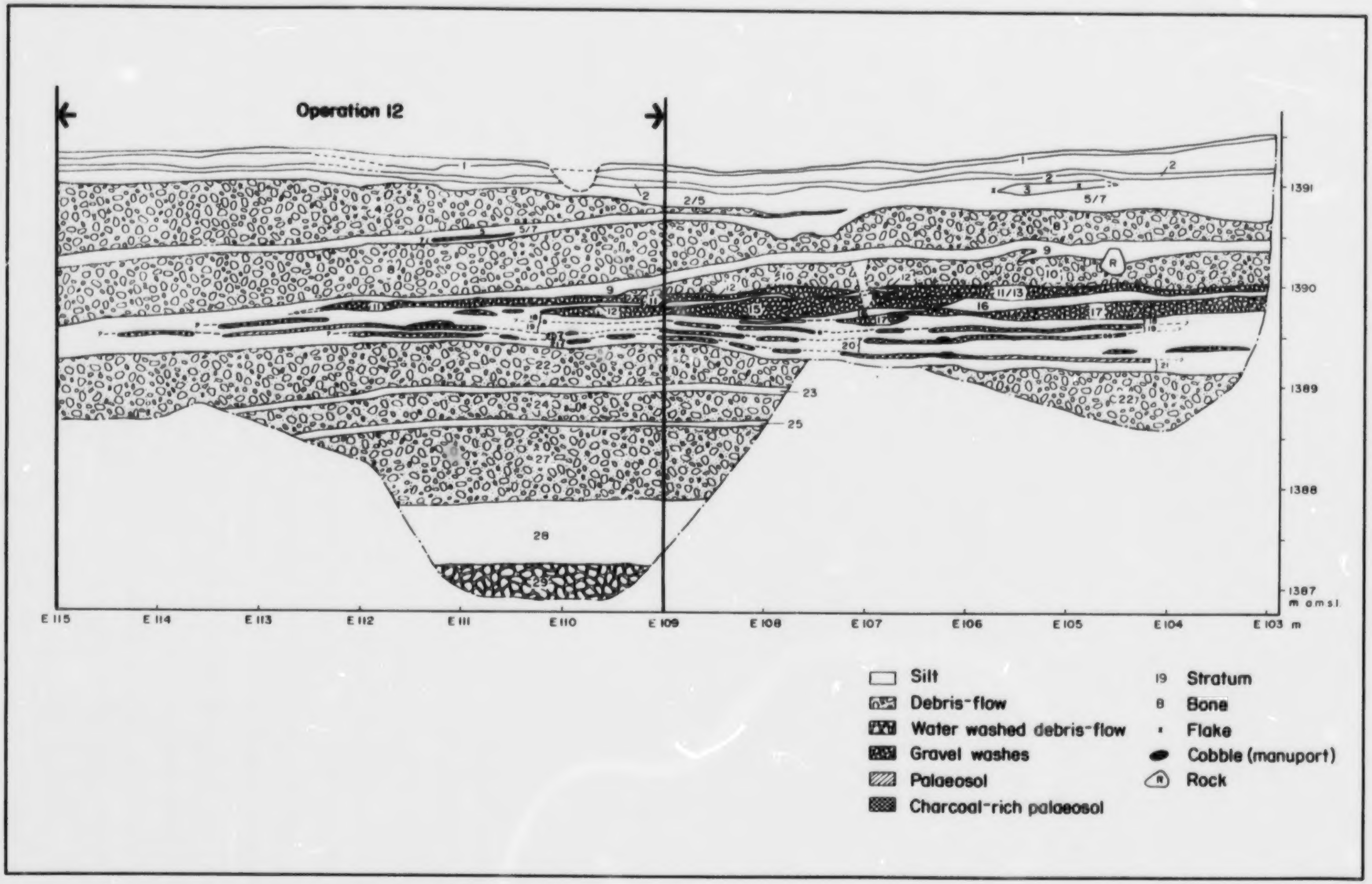

Ngrid
1395
OLD HIGHWAY
LOCALITY B
(502R)
6
5
LOCALITY A
(153R)
10
12
7
13
6
9
2
4
14
8
1390
1388
15
11
1390
1395
TRANS CANADA HIGHWAY
Operation
Contour Interval 1 metre
0
25 METRES

Figure 4. Vermilion Lakes site (153R, 502R).

producing this landform include colluvial or debris-flow events, alluvial action (i.e., downslope of gravel to clay-sized particles by stream flow and/or sheetwash) and aeolian deposition of tephras, fine sands, silts and clays.

Within the excavations, there are three major colluvial units and three major silt units. The major silt units each comprise several separate layers, including cultural levels, sheetwash deposits and palaeosols. In profiles of excavation Units 10 and 12 (Figures 5 and 6), this depositional framework is evident. In a more southerly unit (Operation 2), the upper colluvial deposits have largely petered out but can be correlated with a series of thin alluvial washes (Figure 7). Debris-flow deposits are the salient stratigraphic markers. A minimum of


Operation 12
1
2
3
2/5
5/7
8
9
10
11
11/13
12
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16
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18
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20
21
22
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24
25
27
28
29
R
1391
1390
1389
1388
1387
m amsl
E 115
E 114
E 113
E 112
E 111
E 110
E 109
E 108
E 107
E 106
E 105
E 104
E 103 m
Silt
Debris-flow
Water washed debris-flow
Gravel washes
Palaeosol
Charcoal-rich palaeosol
19 Stratum
B Bone
Flake
Cobble (manuport)
Rock

Figure 5. South profile of Unit 153R10.

22 discrete depositional units have been identified within the major block excavations; each includes a former land surface (most of short duration). Within this context, seven separable cultural layers have been identified.

Cultural Record

In the following summary, each of the ten occupation layers identified will be briefly described. The term occupation, as used here, describes cultural events considered to be roughly coeval, based on radiocarbon dating and stratigraphy. Compressed stratigraphy and bioturbation of upper (post-Mazama) sediments preclude separation of assemblages other than through the use of temporally diagnostic artifacts.

Occupation 1 reveals historic activity at the site. Material remains were limited to a single 57 calibre musket ball (Figure 81) recovered from the surface of the Ae horizon. This occupation should date to between 100 and 200 years B.P.

Occupations 2 through 4 are not well defined due to contextual problems. They occupy the Ae and Bm horizons of the "modern" luvisol which exhibited considerable evidence of ground squirrel activity, and there was clear evidence for mixing of the lithic assemblage in the most productive unit. For the greater part, material recovered from these horizons has been treated as one multimillenial assemblage. At Unit 153R2, Occupation 2 was defined from recovery of a quantity of fire-broken rock and a small scatter of obsidian detritus, both of which were confined to the upper Ae horizon. The Ae horizon contained significant amounts of Bridge River tephra (Fedje and White 1984) which suggests a maximum date of ca. 2,350 years B.P. (Read 1978) for this occupation. Occupation 3 was associated with the mixed Late Prehistoric assemblage present in the lower Ae and Bm horizon; however, the single Late Prehistoric arrow point (Figure 8a) upon which this definition was based might be related to Occupation 2. Occupation 4 was defined from recovery of nine side-notched, basally ground atlatl points (Figure 8c-k) in the Ae and Bm horizons and is tentatively correlated to the Early Middle Prehistoric Period at ca. 5,000 to 7,500 years B.P., based on assignation of the recovered projectile points to the Bitterroot type (Frison 1978; Gryba 1976; Reeves 1973). The Bm horizon contains Mazama

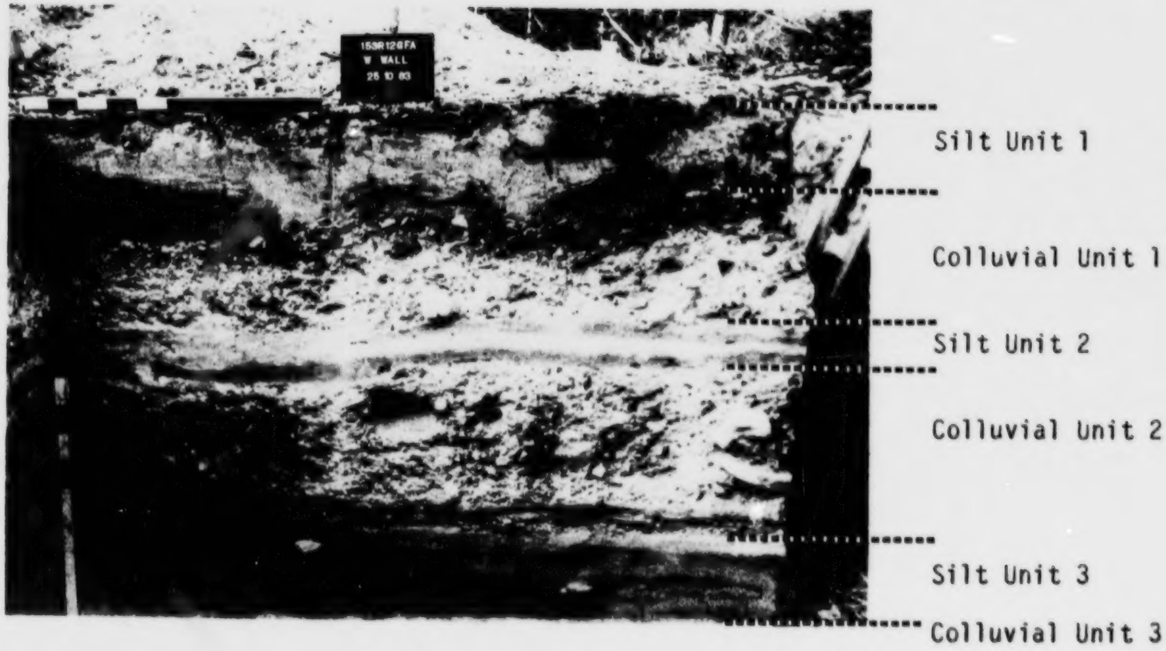

153R12GFA
W WALL
25 10 83
Silt Unit 1
Colluvial Unit 1
Silt Unit 2
Colluvial Unit 2
Silt Unit 3
Colluvial Unit 3

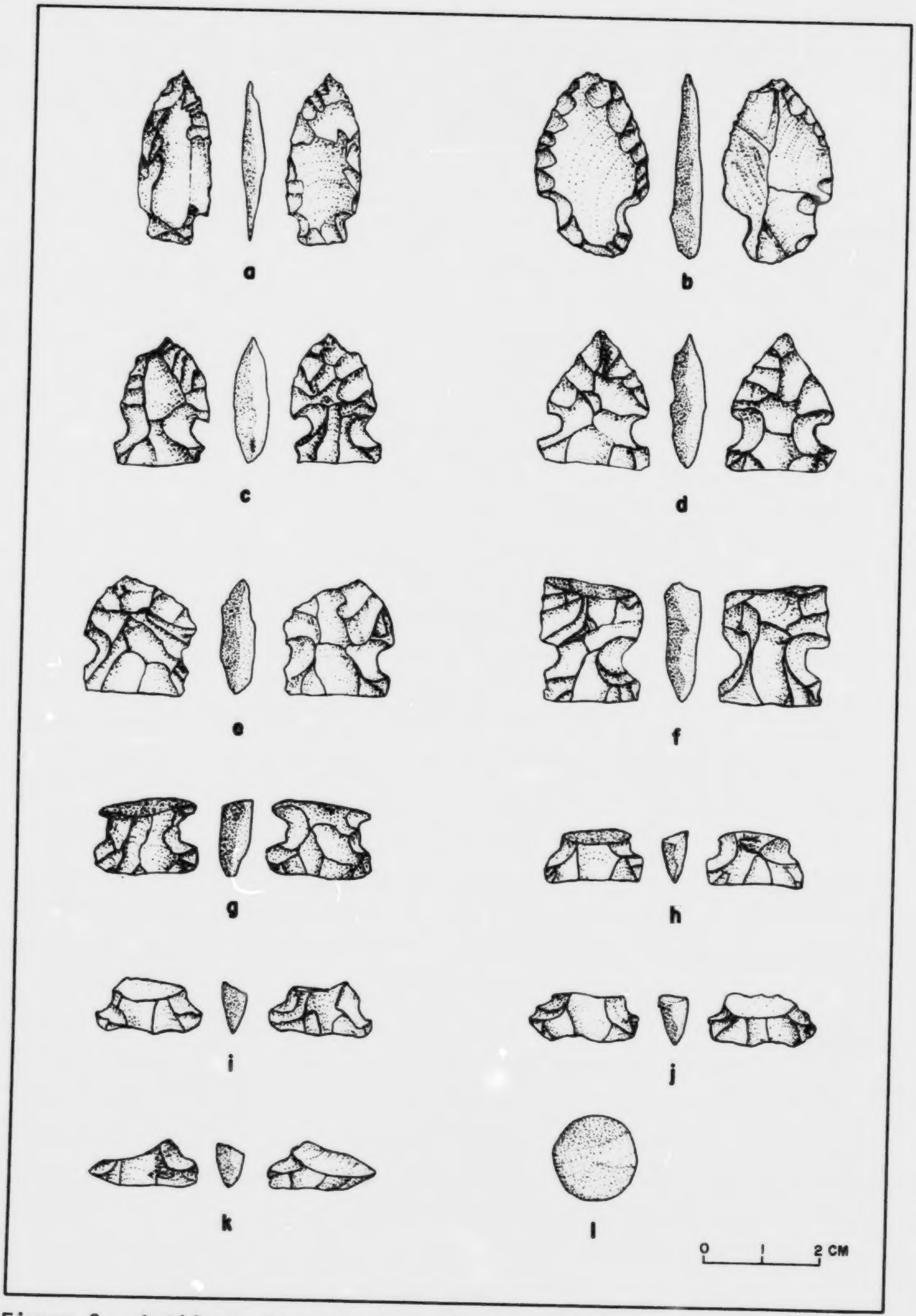
Figure 6. Profile photo of Unit 153R12 west wall.

Figure 7. South wall of Unit 2.

tephra (Fedje and White 1984); however, due to evidence for mixing, significance with regard to the chronology of Occupation 4 is equivocal.

Occupation 5 is the uppermost of the well-stratified pre-Mazama occupation layers. The material culture assemblage was limited to some 450 lithic items, most of which came from one small biface reduction concentration. No temporally diagnostic artifacts were recovered. Organic preservation was extremely poor with no faunal remains recovered and charcoal manifest only as dark stains (for example, see the black stain adjacent to the large cobble in Figure 7, upper right). Features present in this layer included a hearth in Unit 153R7 and an ovate stone-encircled charcoal stain in Unit 153R2. No radiocarbon dates were run for this layer due to the lack of suitable organics. It is tentatively assigned a date of 8,000 to 9,000 years B.P., based on a stratigraphic situation below a pre-Mazama Bt horizon and above a ca. 9,600 years B.P. occupation layer.

Occupation 6a is situated in the upper portion of the silt unit which lies between debris-flow Stratum 4 and debris-flow Stratum 8. It was identified in two excavation units. Material remains comprised about 500 lithic artifacts and a few faunal remains. Included among the lithics were a reworked Agate Basin-Hell Gap type spear point and a pointed biface preform (Figure 9d and e). Faunal remains include sheep (Ovis



a
b
c
d
e
f
g
h
i
j
k
l
0
1
2 CM

Figure 8. Artifacts from the Vermilion Lakes site Locality A (153R).

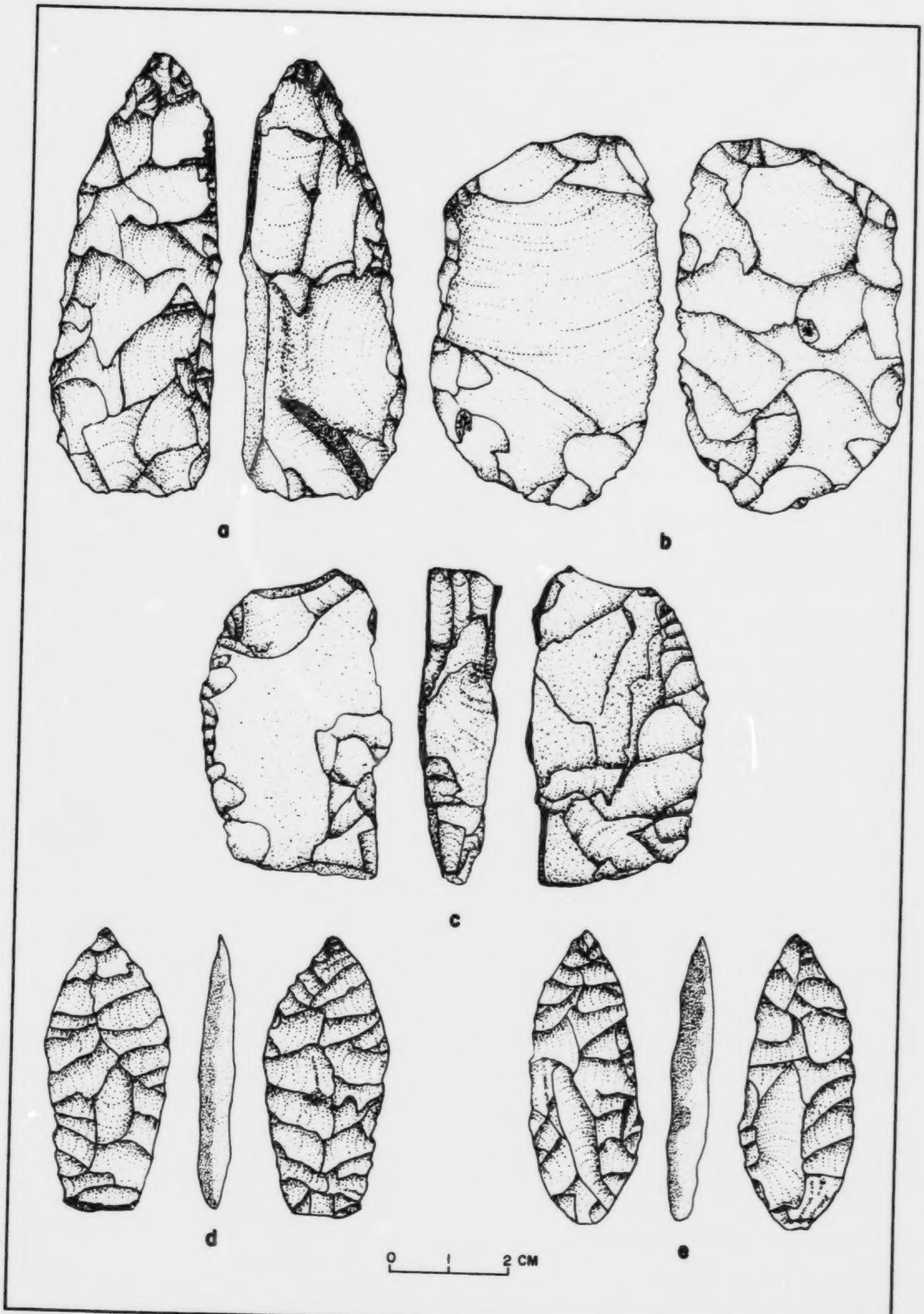

a
b
c
d
e
0 1 2 CM

Figure 9. Artifacts from the Vermilion Lakes site Locality A (153R).

canadensis) and a large ungulate. Features uncovered included two circular surface hearths and surrounding activity area. Five samples were submitted for radiocarbon dating, resulting in three acceptable dates (rejected dates had assays which were clearly inconsistent with stratigraphic position and diagnostic evidence). These included an Accelerator Mass Spectroscopy (A.M.S.) date of 9,700 ± 130 years B.P. (RIDDL 83) on bone associated with a hearth feature in Unit 153R4, a standard (scintillation count) date of 8,950 ± 600 years B.P. (SFU 347) on charcoal from the same hearth, and an A.M.S. date of 9,570 ± 150 years B.P. (RIDDL 75) on a carbonized twig from a hearth feature in Unit 153R2. Following Long and Rippeteau (1974), these support occupation at ca. 9,650 years B.P.

Occupation 6b is situated at the base of the silt unit underlying debris-flow Stratum 4 (Figure 5). Material remains (Unit 12 only) included a small lithic and faunal assemblage associated with a circular surface hearth. No diagnostic artifacts were recovered. A single A.M.S. date of 10,180 ± 130 years B.P. (RIDDL 73) was obtained on charcoal from the base of the hearth. Stratigraphic position suggests the occupation should date to ca. 10,000 years B.P.

Occupation 7 is the uppermost cultural layer in the lower silt unit. The material assemblage included about 300 artifacts and some bone. No diagnostic artifacts were recovered. The faunal assemblages included sheep (Ovis canadensis), beaver (Castor canadensis) and a large ungulate (Bison or Cervus). A large feature uncovered in Unit 153R2 contained a shallow basin hearth and associated activity areas. Radiocarbon dates for this layer include an A.M.S. date of 11,000 ± 1600 years B.P. (RIDDL 217) on a small charcoal sample and a standard date of 9,400 ± 400 years B.P. (SFU 317), also on charcoal. They are not significantly different and have a mean date of 9,490 ± 390 years B.P. Stratigraphy and dating of adjacent cultural layers suggest that this occupation should date slightly earlier at ca. 10,000 years B.P.

Occupation 8 was represented in excavation units 153R7 and 153R12. The former contained a relatively small assemblage but held several elements in common with the latter. The combined assemblage included some 700 lithic items (99% from Unit 153R12) and over 1000 bones and bone fragments. No diagnostic artifacts were present. Tools recovered were associated, for the most part, with butchering activities and included two backed knives (Figure 9a and c) and several choppers. The fauna recovered included sheep (Ovis canadensis), hare (Lepus americanus), bison (Bison bison) and deer (Odocoileus sp.). It is noteworthy that the sheep are significantly larger than the modern form and are described as a phyletically "extinct" subspecies ancestral to the latter (M. Wilson 1984). An extensive butchering activity area occupies all of this layer in Unit 153R12, and indications are that it extends to encompass the animal processing feature uncovered in Unit 153R7. Seven radiocarbon samples have been run for the main activity area and two from that in Unit 153R7. The former group include A.M.S. dates of 10,040 ± 200 years B.P. (RIDDL 71) and 10,040 ± 160 years B.P. (RIDDL 72) on bone and 10,100 ± 210 years B.P. (RIDDL 81) on charcoal, a standard date of 10,090 ± 130 years B.P. (AECV 124C) on bone and a minimum date (no base treatment) of 9,840 ± 60 years B.P. (GSC 3804) on charcoal (some A.M.S. dates for Occupations 8 and 9 are preliminary; final results are documented in Fedje and White [1986]). After Long and Rippeteau (1974), these support an occupation at 10,070 ± 80 years B.P. (the GSC minimum date is not included in calculations). Two anomalously early dates of ca. 11,500 years B.P. are rejected on stratigraphic grounds. No clear explanation can be given for the latter, although burning of old driftwood or deadfall is possible (see, for example, Thompson 1986:116). The dates from Unit 153R7 include an A.M.S. date of 10,060 ± 220 years B.P. (RIDDL 84) on bone and a standard date of 9,800 ± 400 years B.P. (SFU 318) on charcoal. These have a mean of 10,000 ± 190 years B.P. Occupation 8 is therefore suggested to date to ca. 10,050 years B.P. Without recovering diagnostic artifacts, it is not possible to correlate this occupation to known "cultural complexes" as such are not sufficiently well defined in the environs of this study.

Occupation 9 includes the lowest cultural layer at Locality A, units 153R2 and 153R12. The tentative correlation between these units is based on stratigraphic position and dating. The combined material assemblage included in excess of 5,000 lithic artifacts (almost 99% from Unit 153R12) and several hundred bones or bone fragments. No diagnostic artifacts and only a few formed tools (Figure 9b) were recovered. Most of the lithic assemblage is detritus from reducing thin tabular chert cores to bifaces or bifacial tools. At Unit 153R12, small dense clusters of detritus support several discrete reduction sequences. Faunal remains included sheep (Ovis canadensis), deer (Odocoileus sp.), a large ungulate (Cervus sp. or Bison sp.) and a small squirrel-sized rodent. Two small surface hearths were present in Unit 153R2, and in Unit 153R12 a complex activity area occupied most of the excavated cultural layer. This was comprised of a number of features including a circular surface hearth, postholes, and lithic and faunal concentrations (Figure 10). Together these are interpreted as the remains of various camp activities in and around a circular structure, possibly a dwelling. The postholes, which extended down into the underlying colluvium, contained bone fragments and lithic detritus, some of which are refit to artifacts from the living floor and likely fell in the holes when the poles were removed. These postholes coincide with the outer edge of the arc described by the dense lithic concentrations. Seven radiocarbon dates are available for this occupation, including five from the Unit 153R12 activity area and two from unit 153R2. The former include A.M.S. dates of 10,270 ± 100 years B.P. (RIDDL 79) and 10,390 ± 140 years B.P. (RIDDL 70) on bone, 10,570 ± 150 years B.P. (RIDDL 85) on charcoal, and standard dates of 10,900 ± 270 years B.P. (SFU 314) and 11,000 ± 480 years B.P. (SFU 348) on charcoal. Following Long and Rippeteau (1974), the mean date for this group is 10,375 ± 65 years B.P. The Unit 153R2 assays include A.M.S. dates of 10,410 ± 400 years B.P. (RIDDL 216) and 10,660 ± 650 years B.P. (RIDDL 215) and a standard date of 9,200 ± 1300 years B.P. (SFU 349), all on charcoal. These have a mean of 10,400 ± 330 years B.P., which is not significantly different from that determined for Unit 153R12. Additional A.M.S. dates are being run for this and other occupations in order to produce more accurate dates of occupation. It should be noted that the RIDDL Group (Simon Fraser/McMaster University), including Erle Nelson, John Vogel and John Southon, have taken on the Vermilion Lakes site dating programme as part of a research project. As a result, much more detailed chronological data are available for site interpretation than would have been possible otherwise.

As with Occupation 8, these assemblages cannot be assigned to a known cultural complex at present, although they likely predate the classic Agate Basin complex as described by Frison and Stanford (1982) and

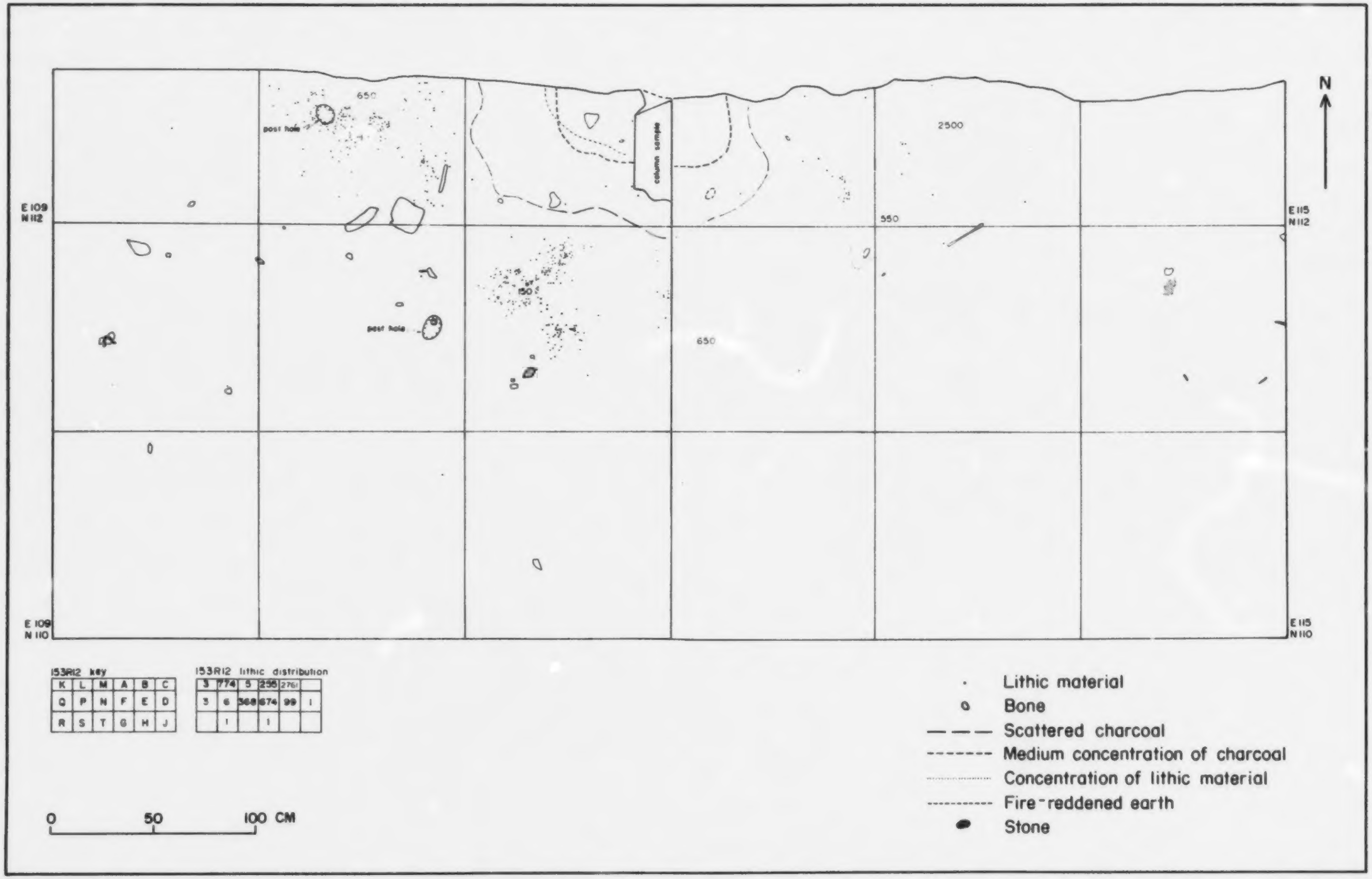

N
E 109
N 112
E 115
N 112
E 109
N 110
E 115
N 110
650
post hole
post hole
column sample
150
2500
550
650
153R12 key
K L M A B C
Q P N F E D
R S T G H J
153R12 lithic distribution
3 774 5 255 2761
3 6 368 674 99 1
1 1
0
50
100 CM
Lithic material
Bone
Scattered charcoal
Medium concentration of charcoal
Concentration of lithic material
Fire-reddened earth
Stone

Figure 10. Unit 153R12, Occupation 9 floor plan.

others. The recovery of Folsom through Clovis type lanceolate spear points (fluted and unfluted) (Fedje 1983; Reeves 1976) at the nearby Minnewanka site (349R) suggests the possibility of association with one of these early "complexes."

LOCALITY B

Stratigraphy

At this locality (502R), stratigraphy is less complex in that the cultural layers are contained in the massive aeolian sediments capping subaqueous (early post-glacial) debris-flow deposits. Testing indicates that the multiple early Holocene debris-flow events observed at Locality A did not extend to this area of the landform. A minimum of five depositional units have been identified in the major excavation block at this locality. Within these deposits, there are four separate occupations.

Cultural Record

Occupation 1 includes historic (post-1910) materials recovered from the surface of the "modern" soil.

Occupation 2 includes a fairly large lithic assemblage (n=5,300) recovered from the Ae and Bm horizons of the "modern" luvisol. Bioturbation of these upper sediments was evident; however, the assemblage is supportive of a single period of occupation in that recovered projectile points (Figure 11b-f) compare favourably to the Pelican Lake type (Reeves 1983), and more than 90 percent of the remains were concentrated in a small area (ca. 10 m^2). This layer is tentatively assigned to the Middle Prehistoric Period.

Occupation 3 was deeply buried (ca. 120 m below surface) and contained only a limited faunal assemblage. There is no firm evidence of cultural activity in this layer.

Occupation 4, at ca. 1.4 m below surface, was the lowest cultural layer at this locality. It was associated with a very weak regosol and was restricted to an area of about ten square metres. Material remains scattered in and around a probable hearth feature included some 100

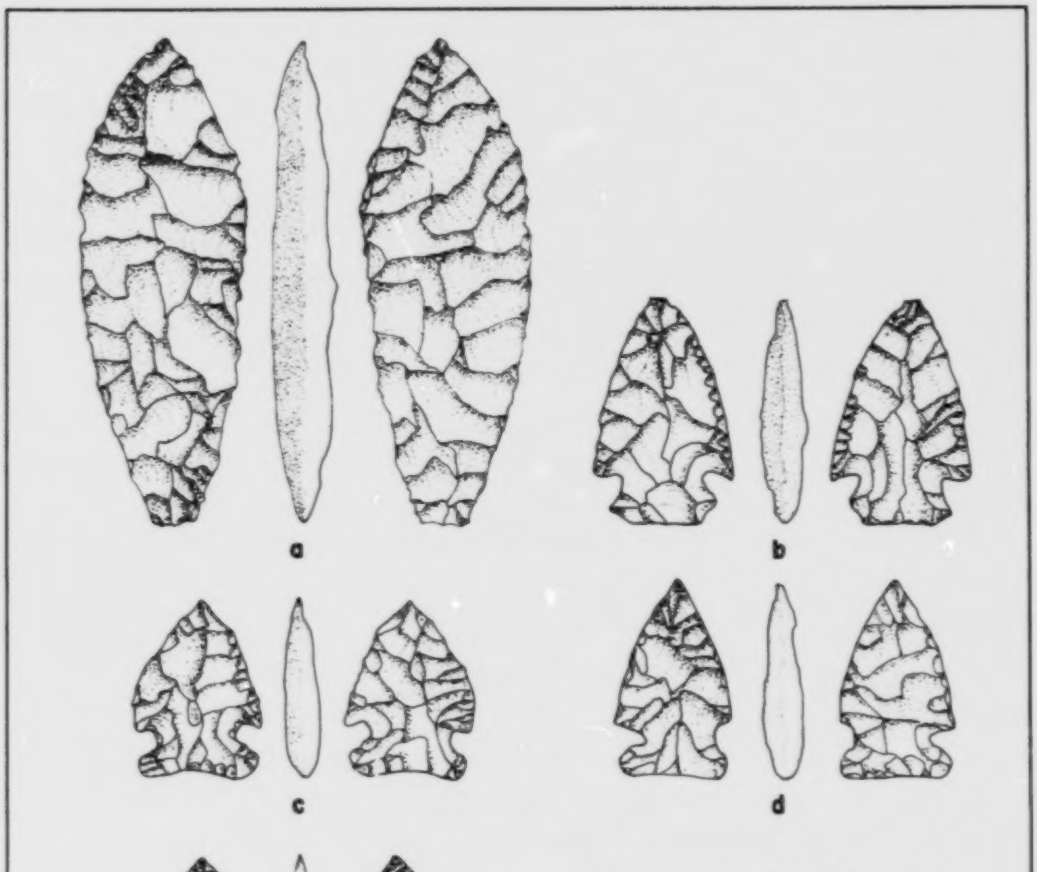

a
b
c
d
e
f
g
h
i
0 1 2 CM
j

Figure 11. Artifacts from the Vermilion Lakes site Locality B (502R).

lithic artifacts and a few bone fragments. One Agate Basin type spear point was recovered. This specimen (Figure 11a) is made of an "exotic" sandy chert and has been reworked on one lateral edge. Three radiocarbon dates were obtained for this layer, including A.M.S. dates of 9,840 ± 200 years B.P. (RIDDL 77) on bone and 10,010 ± 180 years B.P. (RIDDL 82) on charcoal and a standard date of 9,880 ± 140 years B.P. (AECV 121C) on charcoal. These support an occupation of 9,910 ± 95 years B.P. which fits well with the Agate Basin complex association based on diagnostic evidence.

SUMMARY

The Vermilion Lakes site contains an excellent record of early prehistoric occupation at ca. 9,500 to 10,500 years B.P. in the northern Rocky Mountains. The very limited excavations conducted to date form a picture of multiple short-term occupations on a rapidly aggrading landform. A more complete interpretation as to activity and adaptations will await more extensive research, but it is expected that a complex picture will emerge of seasonal utilization of the various ecological niches in the valley with altitudinal shifts to alpine-subalpine regions, following the predictable availability of local resources. There seems to be little doubt that a rich and varied fauna was available through this period. Palynological and other biophysical evidence (Fedje and White 1986) support a more open landscape with more shrubs and herbs than at present and a climate with warmer and drier summers but somewhat colder winters. The main period of transition from a Late Pleistocene flora/environment had passed by 12,000 years B.P.

THE CHRISTENSEN SITE

In the summer of 1985, Parks Canada conducted preliminary testing of a deeply stratified prehistoric site some 10 km west of Banff townsite (Fedje n.d.). The Christensen site (360R) is situated on a debris-flow fan fronting the north bank of the Bow River (Figure 3). Originally described as a shallow Late Middle to Late Prehistoric site (Christensen 1971), it is now recognized as being deeply stratified with the earliest occupations dating to the Early Middle Prehistoric Period. When examined in 1985, prehistoric remains were observed eroding out of buried palaeosols both above and below a thick Mazama ash layer. The site is bisected by the C.P.R. mainline, and erosion is signficant, both in the cut and along the river (Figures 12 and 13).

Three 1x1 m tests were excavated in 1985, including two along the river cutbank and one in the eroded slope of the north C.P.R. cutbank (Figure 14). All were productive. Analysis of recovered data is incomplete; therefore, the following will only include a brief preliminary descriptions.

STRATIGRAPHY

Stratigraphy varies considerably across the site. Towards the back (north) of the known site area (Figure 13), there are multiple debris flows of both pre- and post-Mazama age (Roed and Wasylyk 1973), while at the toe of the landform, the only evidence of these in post-Mazama times are thin, granule washes (Figure 15). Deposition varies across the landform as well, especially north of the C.P.R. tracks where the lowest cultural layer ranges from 2 to 4 m below the modern land surface.

CULTURAL RECORD

The three test excavations were some distance apart and thus secure correlation of cultural layers encountered is not feasible; however, a minimum of nine occupations are present, based on stratigraphy and recovery of time diagnostic artifacts (Figure 16). From these data the following represents a very tentative aggregation of material evidence.

Occupation 1 material cultural remains were limited to two rifle cartridges. One (Figure 17a) is a 44 Henry Flat, Long Case double rim-fire cartridge. It has no headstamp and compares most closely to the type produced by Ethan Allen Co. between 1866 and 1872 (Suyom 1960:105). The other (Figure 17b) is a 45-75 Winchester cartridge, the base of which has been sawn off. Without a base, this specimen cannot be tied to a specific manufacturer. The 45-75 cartridge was in production from 1876 to 1935. Tentatively, these items relate to activity at ca. 1880-1890.

Figure 12. Excavating unit 360R2 at the Christensen site, view to the west.

Figure 13. C.P.R. cutbank at the Christensen site (360R), view to the west.

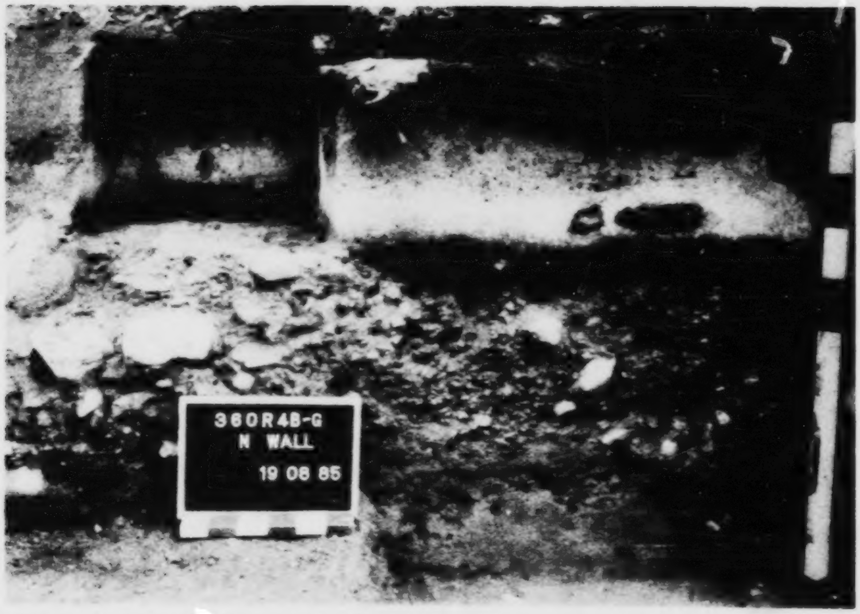

360R4B-G
N WALL
19 08 85

Figure 14. Profile photo of Unit 360R4.

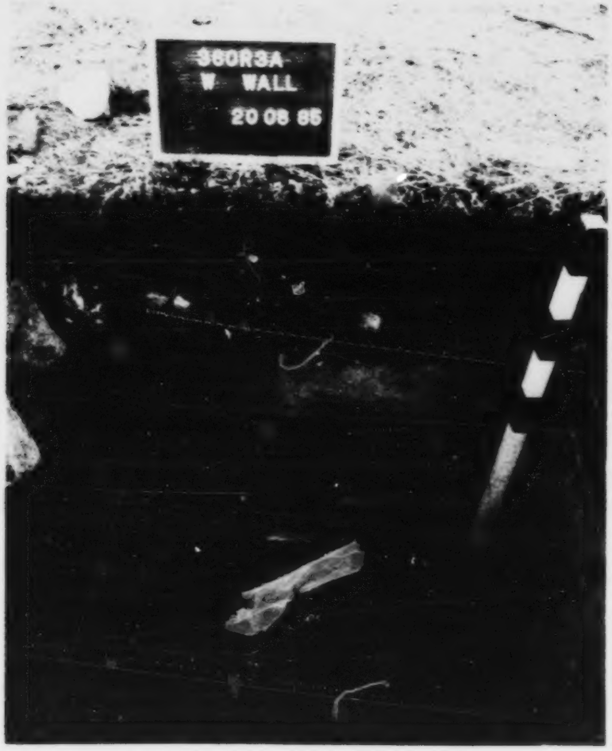

360R3A
W WALL
20 08 85

Figure 15. Profile photo of 360R3.

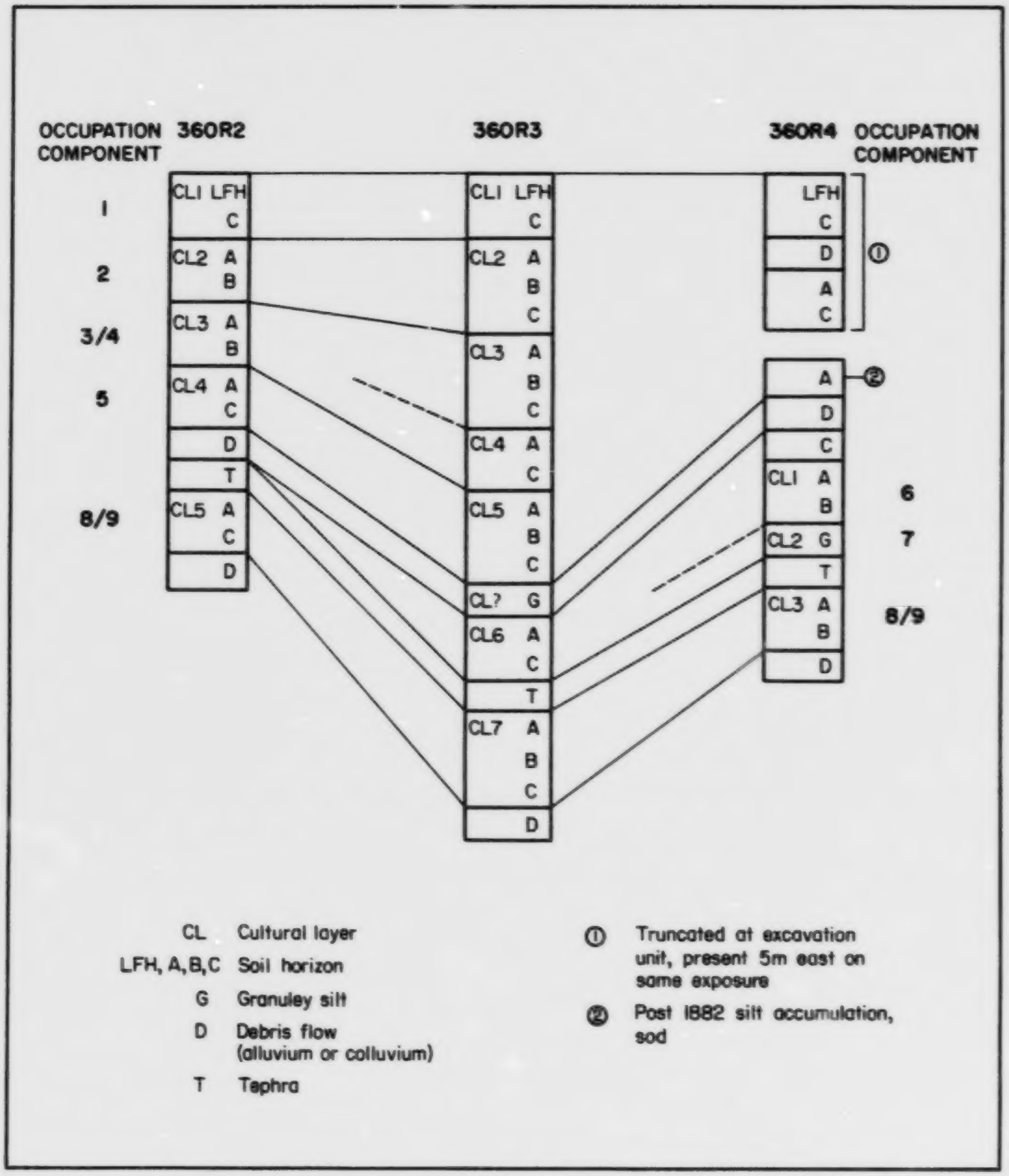

OCCUPATION COMPONENT
360R2
360R3
360R4
OCCUPATION COMPONENT
1
2
3/4
5
8/9
CL1 LFH
C
CL2 A
B
CL3 A
B
CL4 A
C
D
T
CL5 A
C
D
CL1 LFH
C
CL2 A
B
C
CL3 A
B
C
CL4 A
C
CL5 A
B
C
CL? G
CL6 A
C
T
CL7 A
B
C
D
LFH
C
D
A
C
①
A
②
D
C
CL1 A
B
CL2 G
T
CL3 A
B
D
6
7
8/9
CL Cultural layer
LFH, A, B, C Soil horizon
G Granuley silt
D Debris flow (alluvium or colluvium)
T Tephra
① Truncated at excavation unit, present 5m east on same exposure
② Post 1882 silt accumulation, sod

Figure 16. Tentative correlation of cultural layers at the Christensen site (360R).

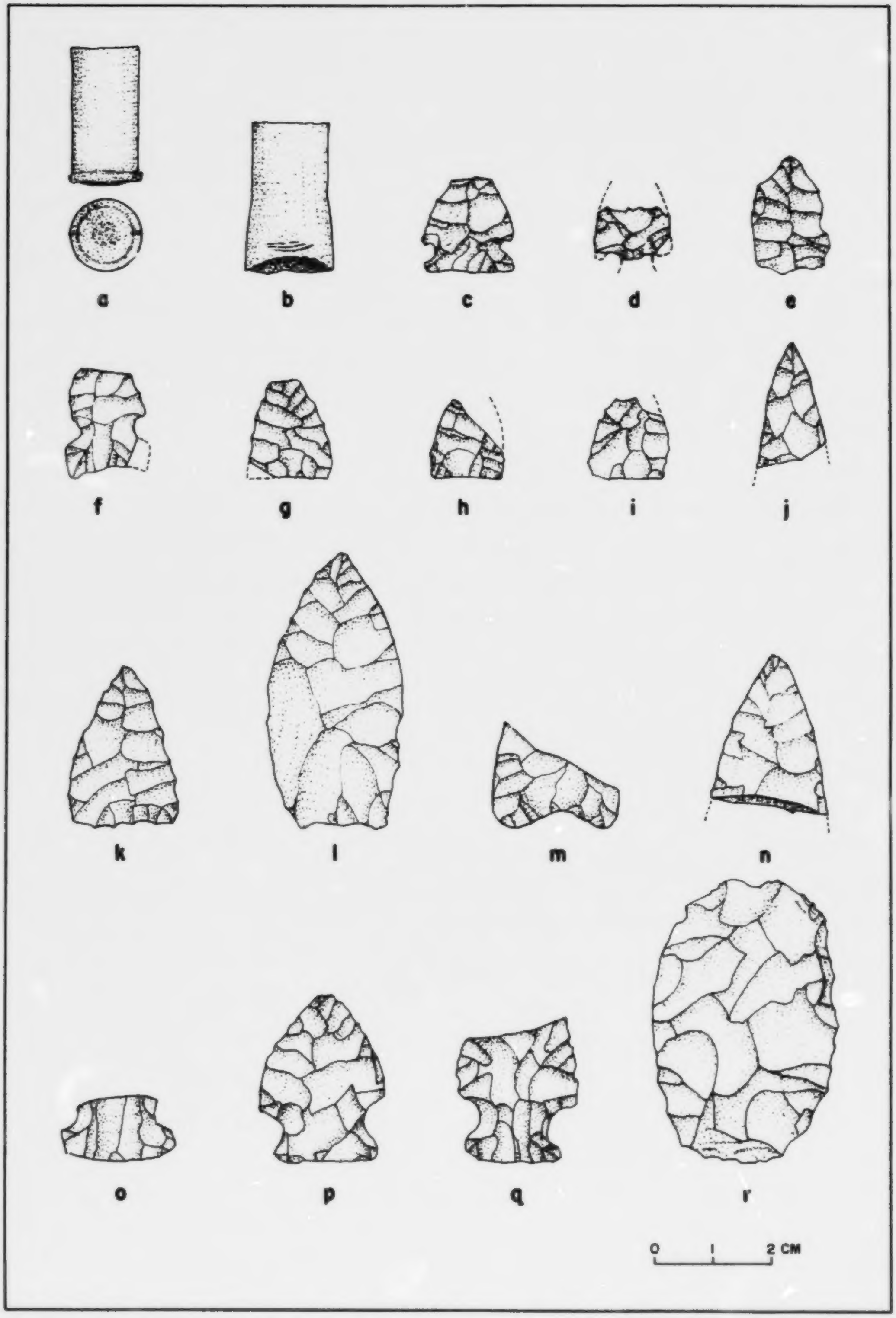

a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
0
1
2 CM

Figure 17. Artifacts from the Christensen site (360R).

This time frame would fit well with the 1882 construction of the C.P.R. in this area.

Occupation 2 produced two small, side-corner notched arrowpoints (Figure 17c and d) and several preforms, as well as a limited quantity of detritus. Fanual remains recovered included bison (Bison bison) and sheep (Ovis canadensis). Until a larger sample of diagnostic artifacts is obtained and/or radiocarbon dates are returned, this occupation can only be assigned to the Late Prehistoric Period.

Occupation 3 was somewhat more productive of lithic and faunal remains. Several triangular arrow points or preforms were included in the lithic assemblage (Figure 17g-i and k). Fauna recovered included bison (Bison bison), black bear (Ursus americanus), deer (Odocoileus sp.) and ground squirrel (Spermophilus richardsonii). Two fire pits uncovered in this occupation contained substantive quantities of bone, charcoal and fire-broken rock. Until radiocarbon results are returned, this occupation can only be typologically dated to the Late Prehistoric Period.

Occupation 4 was only identified in excavation Unit 360R3 and produced a fairly limited lithic and faunal assemblage. No diagnostics have been identified in association with this feature. A Late Middle Prehistoric or Early Late Prehistoric affiliation is indicated, based on stratigraphic position.

Occupation 5 produced two atlatl point fragments (Figure 17m and n) and a limited quantity of tools and detritus. Faunal remains included bison (Bison bison) and a small number of unidentifiable bone fragments. One of the point fragments is a base which corresponds well to the McKean Lanceolate type, suggesting occupation between ca. 4,200 and 3,500 years B.P.

Occupations 6 and 7 produced only scant remains with no diagnostics and little faunal material.

Occupation 8 was present only in excavation Unit 360R3. The cultural layer is separated from that of excavation Unit 360R4, which occupies a similar position below the thick Mazama ash layer, on the basis of recovery of diagnostic artifacts. The Occupation 8 assemblage includes a substantial number of lithic items but a relatively limited faunal assemblage. The latter includes a large unspeciated ungulate and a number of unidentifiable fragments. A recovered projectile point base

(Figure 17o) is classed as Bitterroot Side Notched. Occupation 8 should date between the Mazama ashfall at ca. 6,850 years B.P. (Bacon 1983) and 7,800 years B.P. as this point type dates ca. 5,000-7,800 years B.P. in the Northwestern Plains-Rocky Mountains area (Frison 1978; Gryba 1976).

Occupation 9 was present only in excavation Unit 360R4. Again, this layer produced large numbers of lithic remains, although faunal material was virtually absent. Two large corner-notched atlatl points (Figure 17p and q) were present in the lithic assemblage which was strongly dominated by biface production detritus. No identifiable faunal remains were recovered. This occupation is suggested to date to ca. 7,000-8,000 years B.P., based on the recovery of time diagnostic artifacts (cf., Doll 1982; Husted and Edgar n.d.; Ronaghan 1985).

SUMMARY

A relatively substantive body of data was recovered from the very minor programme conducted in 1985. It is clear that this site, with its well-preserved record of some 8,000 years of cultural activity, is highly significant and has great potential for palaeocultural and palaeontological interpretation. A more comprehensive conservation programme, with a focus on stabilization of eroding sediments, is proposed for the coming years.

THE SECOND LAKE SITE

During 1985, the Archaeological Research Unit of Parks Canada conducted a mitigative programme in response to a proposal by Alberta Government Telephones to construct a buried trunk line between Banff townsite and the Sunshine Interchange some 10 km west (Fedje 1985, 1986). The alignment was restricted to the edge of pavement but, in the Vermilion Lakes area, passed through several known sites, some of which exhibited potential for deep stratification (I. Wilson 1984). Systematic deep tests (0.5 x 1.0 m x 1.2 m deep) excavated at the road edge/ditch encountered prehistoric remains at several locales. These were tested more intensively, and one area of the Second Lake site (162R) produced evidence for intact stratified cultural deposts. Salvage excavations conducted at this locale were productive.

The Second Lake site (162R) is situated on an alluvial fan fronting the northwestern edge of Second Vermilion Lake. A linear block was excavated and expanded, based on test results, to include a total area of 19 square metres (Figure 18). Nine separate occupations were identified. At the time of writing, analyses are incomplete; therefore, the following will briefly document preliminary results.

STRATIGRAPHY

A minimum of 24 depositional strata are present within the ca. 3 m of sediments excavated during the programme (Figure 19). These include both regosolic aeolian silts and massive alluvial debris flows. From upper to lower, Stratum 1 is a 30-40 cm thick silt unit which includes at least one prehistoric cultural layer; Stratum 2 is a 50-60 cm thick layer of unsorted alluvium (to cobble size). Stratum 3 is a thin granule rich silt wash exhibiting no soil development; strata 4 through 13 are palaeosols associated with cultural remains. Strata 14, 15 and 16 comprise silty debris flows and alluvial gravels and cobbles; Stratum 17 is a minor granule rich silt wash. Strata 18 through 23 are palaeosols associated with cultural activity, and Stratum 24 is a massive alluvial debris flow. The latter represents the limit of testing at this locale.

No distinct tephras were observed during excavation but post-field analysis indicates that this is the result of masking by cultural activity and soil development. Magnetic minerals (a component of tephra) were extracted from twelve 50g silt samples. These included samples from natural (silt) layers 4 through 13 of the upper silt member and from layer 22 of the lower silt member (Figure 19). Natural layer 12 was subdivided into upper (12U), middle (12M) and lower (12L) levels in order to maintain the minimum 5 cm level control employed during excavation. Results of the analysis are presented in Figure 20. These indicate that layers 6 and 12 contain a significant tephra component. Positive identification is pending, but these are expected to correspond to the Bridge River ashfall at ca. 2350 years B.P. (Read 1978) and the Mazama ashfall at ca. 6850 years B.P. (Bacon 1983), respectively. These are

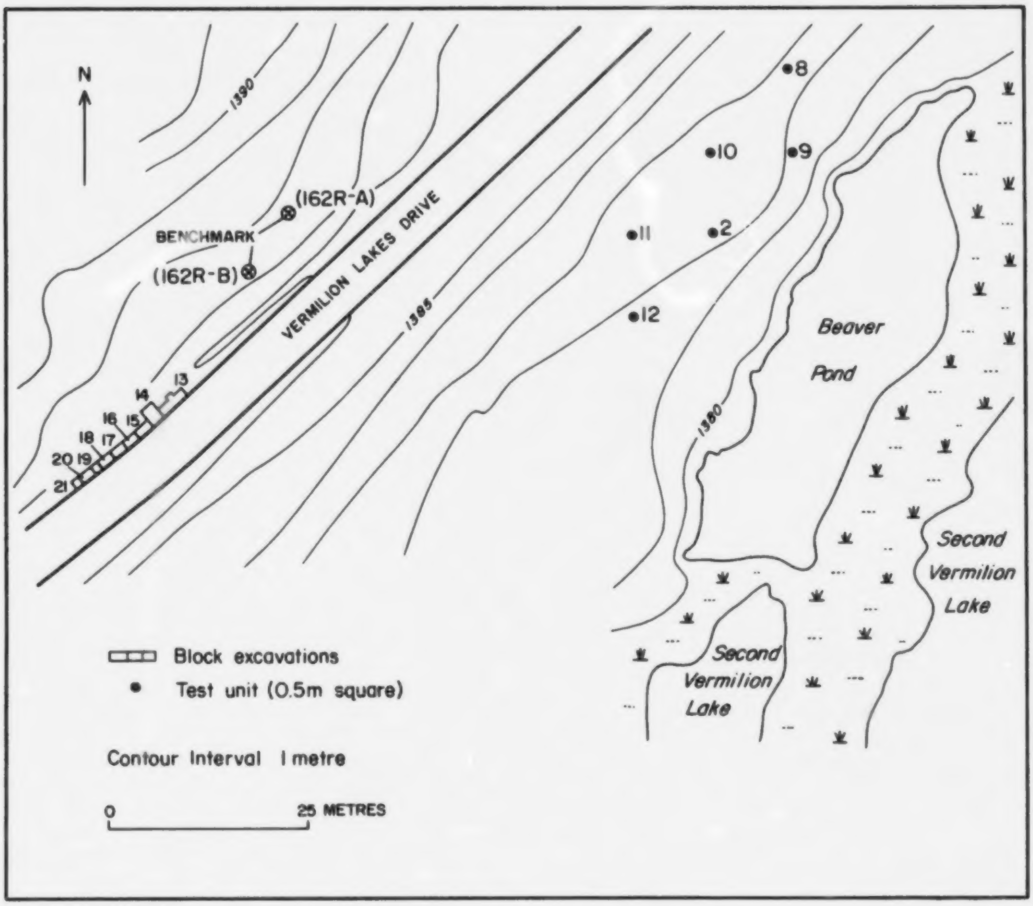

N
1390
1385
1380
BENCHMARK
(162R-A)
(162R-B)
VERMILION LAKES DRIVE
13
14
15
16
17
18
19
20
21
•8
•9
•10
•11
•2
•12
Beaver
Pond
Second
Vermilion
Lake
Second
Vermilion
Lake
Block excavations
Test unit (0.5m square)
Contour Interval 1 metre
0
25 METRES

Figure 18. Second Lake site (162R).

the only Holocene tephra events well represented in this area of Banff National Park. Radiocarbon assays support this interpretation (Table 4).

CULTURAL RECORD

Occupation 1 was not present in the block excavation as the upper silts had been removed by highway construction in the 1910s; however, flakes were recovered from nearby surface exposures of this layer and from shallow tests excavated in the environs in 1984 (I. Wilson 1984).

Occupations 2 and 3 were associated with natural layers 4 and 6, respectively. These contained only limited material cultural remains and no temporally diagnostic artifacts. Faunal remains recovered included bison (Bison bison) and beaver (Castor canadensis). The radiocarbon

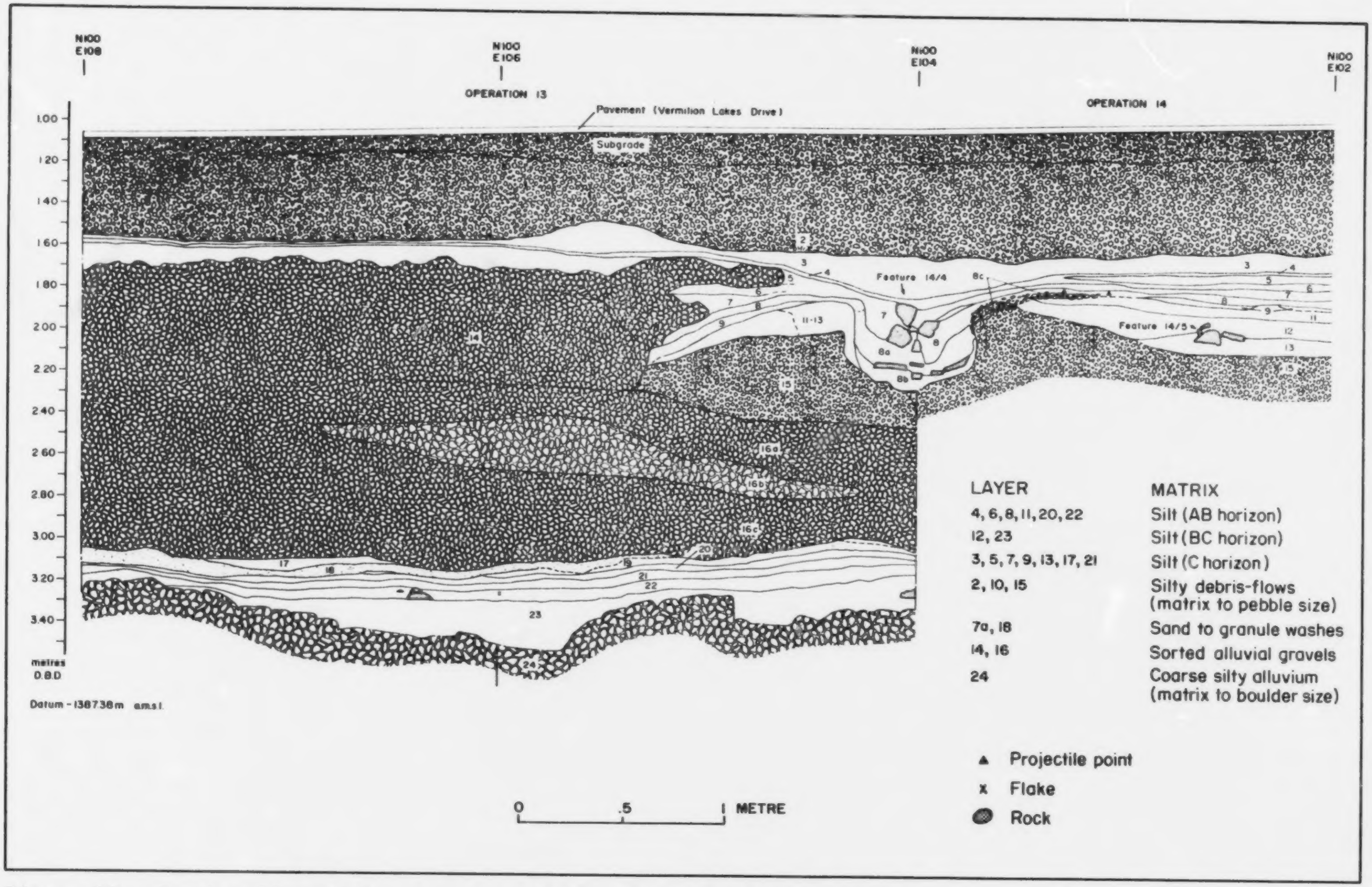

N100 E108
N100 E106
N100 E104
N100 E102
OPERATION 13
OPERATION 14
Pavement (Vermilion Lakes Drive)
Subgrade
Feature 14/4
Feature 14/5
1.00
1.20
1.40
1.60
1.80
2.00
2.20
2.40
2.60
2.80
3.00
3.20
3.40
metres
0.B.D
Datum - 1387.38m a.m.s.l.
LAYER
4, 6, 8, 11, 20, 22
12, 23
3, 5, 7, 9, 13, 17, 21
2, 10, 15
7a, 18
14, 16
24
MATRIX
Silt (AB horizon)
Silt (BC horizon)
Silt (C horizon)
Silty debris-flows (matrix to pebble size)
Sand to granule washes
Sorted alluvial gravels
Coarse silty alluvium (matrix to boulder size)
▲ Projectile point
x Flake
● Rock
0
.5
1 METRE

Figure 19. South wall profile of units 162R13, 14 at the Second Lake site.

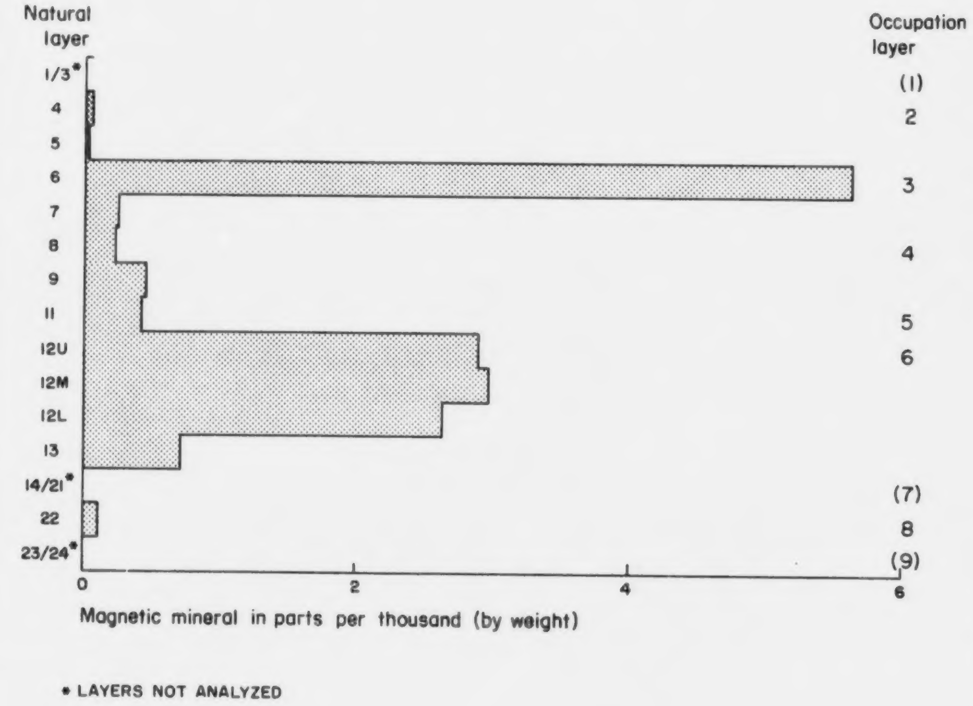


Figure 20. Magnetic mineral concentrations by layer at the Second Lake site.

dates of 1920 ± 120 years B.P. (S 2760) and 2,165 ± 115 years B.P. (S 2758), respectively (see Table 4), are consistent with stratigraphy which supports a post-2,350 years B.P. time frame.

Occupation 4 was associated with natural layer 8 and produced a small material cultural assemblage. The lithic assemblage comprised some 100 items including several corner-notched projectile points (Figure 21a-d) tentatively associated with the Pelican Lake Phase (Reeves 1983). Faunal remains included bison (Bison bison), goat (Oreamnos americanus) and sheep (Ovis canadensis). Several features were uncovered, including a slab-lined hearth. Radiocarbon dates of 2,805 ± 130 years B.P. (S 2756) on hearth charcoal and 2,520 ± 210 years B.P. (S 2757) for scattered charcoal fit well to the Pelican Lake assignation. They have a mean of

Table 4. Second Lake site radiocarbon dates*.

LAB NO.	DATE (YRS B.P.)	MATERIAL	OCCUPATION	PERIOD
S 2759	9,455 ± 450	charcoal	8	Early Prehistoric
S 2778	3,560 ± 135	charcoal	6	Middle Prehistoric (Hanna)
S 2754	2,540 ± 120[r]	bone	6	Middle Prehistoric (Hanna)
S 2755	3,100 ± 125	charcoal	5	Middle Prehistoric (Pelican Lake)
S 2779	2,760 ± 95	bone	5	Middle Prehistoric (Pelican Lake)
S 2756	2,805 ± 130	charcoal	4	Middle Prehistoric (Pelican Lake)
S 2757	2,520 ± 210	charcoal	4	Middle Prehistoric (Pelican Lake)
S 2758	2,165 ± 115	charcoal	3	Middle Prehistoric
S 2760	1920 ± 120	bone	2	Middle Prehistoric

* C-13 corrected

[r] Rejected, date is inconsistent with layer association, bone recovered on end may be intrusive

Occupation 5 mean is 2,885 ± 75 years B.P. after Long and Rippeteau (1974).

Occupation 4 mean is 2,735 ± 110 years B.P. after Long and Rippeteau (1974).

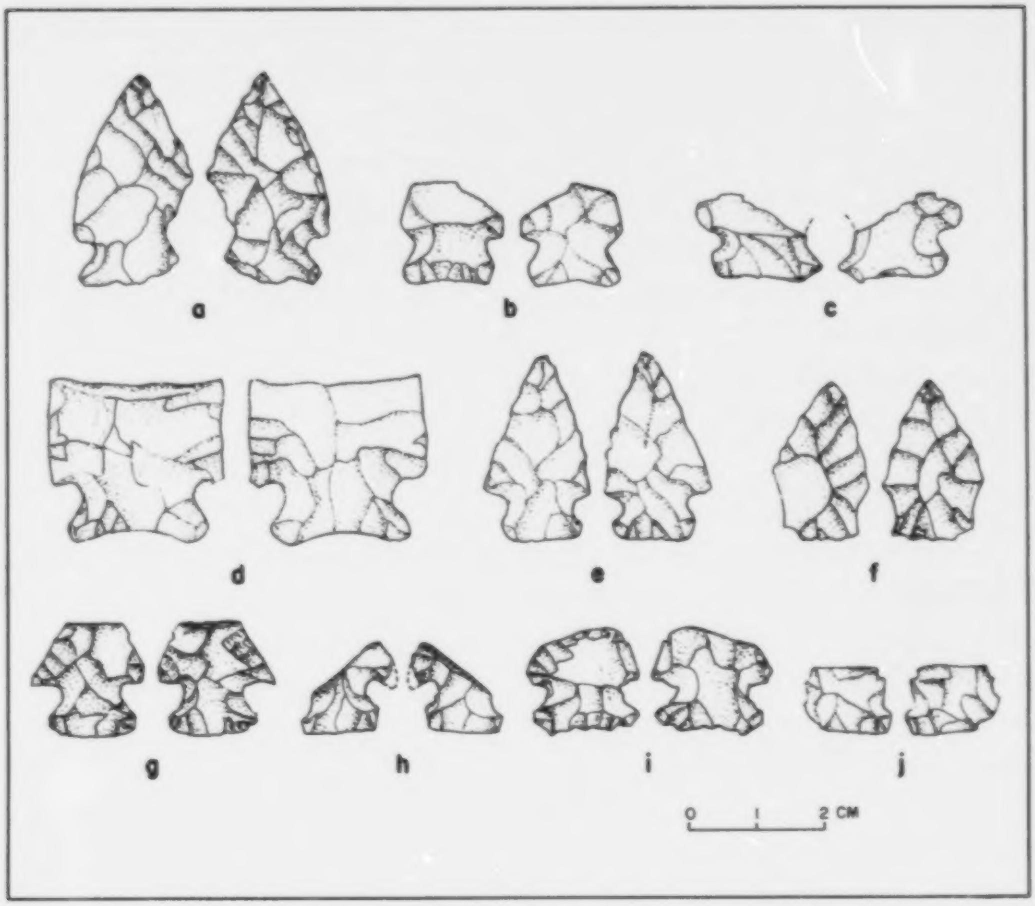


Figure 21. Artifacts from the Second Lake site (162R).

2,735 ± 110 years B.P. (Long and Rippeteau 1974) but could relate to distinct occupations of a stable land surface.

Occupation 5, associated with natural layer 11, was fairly productive, with a lithic assemblage including some 350 items. Animal species present included bison (Bison bison), deer (Odocoileus sp.), dog or wolf (Canis sp.), ground squirrel (Spermophilus richardsonii), mallard (Anas platyrhynchos) and trout (Salmo sp.). Hearths associated with quantities of fire-broken rock are present. A Late Middle Prehistoric affiliation is indicated from stratigraphic and diagnostic evidence (Figure 21f-h). Two radiocarbon dates are available for this occupation layer. These include a date of 3,100 ± 125 years B.P. (S 2755) on hearth charcoal and 2,760 ± 95 years B.P. (S 2779) on scattered bone. Although temporally distinct activities may be represented, the dates are not significantly different and have a mean of 2,885 ± 75 years B.P. which is consistent with the latter evidence.

Occupation 6 coincided with the upper portion of natural layer 12. It contained some 650 lithics and a faunal assemblage including bison (Bison bison), deer (Odocoileus sp.) and beaver (Castor canadensis). Projectile points (Figure 21f-j) comparable to the Hanna type of the McKean Complex (Brumley 1975) were recovered from this layer; however, these specimens also fall within the range of variation of Early Middle Prehistoric types, such as Salmon River Side Notched. The presence of Mazama (tentative identification) tephra in and below this layer supports a post-6,850 years B.P. time frame. A date of 3,560 ± 135 years B.P. (S 2778) obtained on charcoal from this layer is consistent with the Hanna horizon assignation. A second date of 2,540 ± 120 years B.P. is rejected as being intrusive (see Table 4).

Occupations 7 through 9 produced only limited quantities of lithic artifacts in association with weak regosols (natural layers 20, 22 and 23, respectively). The age of these layers is greater than 7,000 years B.P., as they underlie massive debris flows and a cut-and-fill disconformity which in turn underlie the (Mazama?) ash layer. A small charcoal sample collected from Occupation 8 was dated to 9,455 ± 450 years B.P. (S 2759).

SUMMARY

While only a very small portion of the Second Lake site has been intensively examined to date, it clearly holds considerable potential in developing and explaining the local and regional palaeocultural record. The 1985 excavations recovered elements of a well-preserved Late Middle Prehistoric record; however, recovery of arrow points elsewhere in the site and of cultural material underlying Mazama tephra suggests that the site has highly significant Late and Early Prehistoric records as well.

THE ECHO CREEK SITE

During 1984, Parks Canada conducted excavations at the Echo Creek site as a part of the Public Works Canada sponsored mitigation of the

Trans-Canada Highway Twinning development (Robinson 1986). This well-stratified prehistoric site occupies the overbank/aeolian deposits of a low fluvial terrace at the eastern end of the Vermilion Lakes wetlands (Figure 3). The site was occupied during the Late Middle Prehistoric and Late Prehistoric periods and contains a minimum of six discrete occupations. It is beyond the scope of the present report to detail the very substantial material record obtained from this site (see Robinson 1986). The following will include only a brief description of site stratigraphy and salient occupations.

STRATIGRAPHY

Situated on the alluvial delta of Forty Mile Creek, the depositional record of the Echo Creek site is dominated by fluvial sediments. Bridge River tephra underlies the cultural layers and provides a basal limit of ca. 2350 years B.P. for the prehistoric record. No developed soils were observed below this ash layer, but above it were a series of dark charcoal rich palaeosols (Figure 22). These are generally very well defined, at least in part due to human occupation (numerous animal processing and hearth features).

CULTURAL RECORD

Occupation 1 comprised the post-1890s historic material remains.

Occupation 2 was relatively unproductive and produced no diagnostic stone tools. Assignation is to the Late Late Prehistoric Period on stratigraphic bases.

Occupation 3 was by far the most productive occupation with several thousand lithic remains and a large faunal assemblage. The lithic assemblage included 38 small side-notched projectile points (most were flake points), some of which are illustrated in Figure 23 (a-i and k), and several triangular points or preforms (Figure 23m-p). The faunal assemblage included bison (*Bison bison*), elk (*Cervus canadensis*), moose (*Alces alces*), mule deer (*Odocoileus hemionus*), sheep (*Ovis canadensis*), beaver (*Castor canadensis*), porcupine (*Erethizon dorsatum*), a canid (*Canis* sp.), muskrat (*Ondatra zibethicus*), rabbit (*Lepus americanus*),

SOUTH WALL
24 09 84

Figure 22. Profile photo of Unit 515R3 at the Echo Creek site (515R).

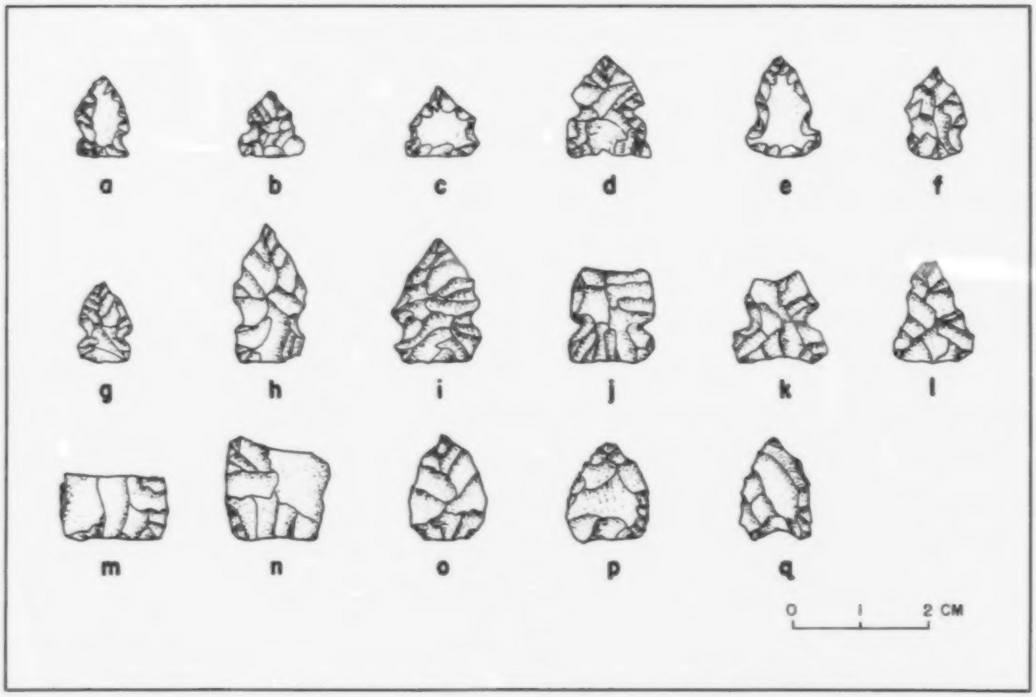

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Figure 23. Artifacts from the Echo Creek site (515R).

ground squirrel (Spermophilus richardsonii), coot (Fulicia americana), sucker (Catostomus commersoni) and a salmonid (trout or char). Several activity areas, including lithic heat treating/reduction foci and animal processing features, were uncovered in association with hearths and large quantities of fire-broken rock. Radiocarbon dates include charcoal dates of 650 ± 100 years B.P. (BSG 1015), 710 ± 100 years B.P. (BSG 1011), 770 ± 100 years B.P. (BSG 1014) and a bone date of 620 ± 100 years B.P. (BSG 1018). A Late Late Prehistoric occupation at ca. 690 ± 50 years B.P. is supported by these dates and fits well with the diagnostic evidence.

Occupation 4 was associated with a weakly developed soil and contained a very limited cultural assemblage. Correlation with the Avonlea Phase of the Late Prehistoric Period is suggested (Robinson 1986) on the basis of stratigraphic position between Besant and Late Late Prehistoric cultural layers and the recovery of a finely made small side-notched point (Figure 23j).

Occupation 5 produced a small but interesting assemblage. The lithic assemblage included four large side notched atlatl points (Figure 24a-d), in addition to a very limited number of retouched items and sparse scatterings of detritus. The faunal assemblage included bison (Bison bison) and an unspeciated small ungulate. Two hearth features and limited quantities of fire broken rock were associated with this layer. Radiocarbon dates obtained for this occupation include 1325 ± 125 years B.P. (BSG 1012) and 1540 ± 100 years B.P. (BSG 1013) on charcoal, and support activity at ca. 1450 ± 70 years B.P. A correlation to the Late Middle Prehistoric Besant Phase is indicated by recovery of diagnostic projectile points, and the radiocarbon assays suggest association with the later portion of this phase.

SUMMARY

The Echo Creek site holds considerable interpretive potential. The site is highly significant in that, in addition to an excellent Late Late Prehistoric record, it affords evidence of a well-stratified Besant component which, at present, is unique in this area of the northern Rocky Mountains.

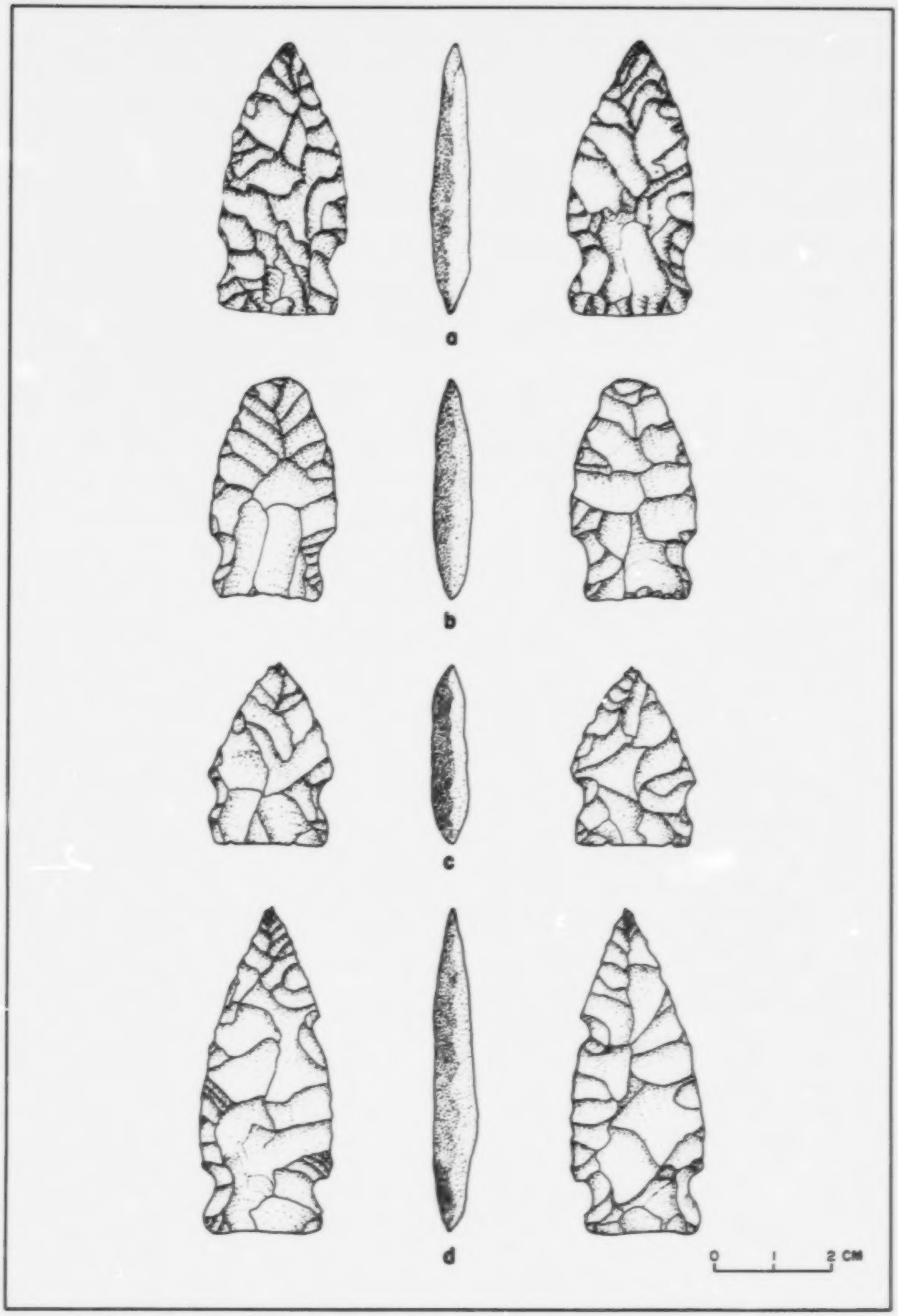

Figure 24. Artifacts from the Echo Creek site (515R).

CONCLUSION

Each of the sites described above has a considerable repository of cultural data in excellent context. Together they comprise a relatively complete, though skeletal, representation of the Northwestern Plains cultural constructs (Frison 1978; Reeves 1983). Synthesis of these data and those from other ongoing and proposed projects will aid considerably in interpretation of both local and regional cultural adaptations/changes over the past ten to eleven millenia.

These studies show that the environs of Banff National Park are far from marginal in terms of past cultural activity. In fact, not only was this area used extensively throughout the past ten to twelve millenia, but the physical environment itself is of great benefit to archaeologists. The Bow valley is dominated by mass-wasting landforms (i.e., alluvial and colluvial fans) which, over the millenia, have sealed and stratified this evidence and, by their very mass, slowed post-depositional erosion so destructive of valley landforms in much of the Plains area.

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LATE QUATERNARY LANDSCAPE MODIFICATION IN THE COCHRANE-CALGARY AREA OF THE BOW VALLEY AND ITS INFLUENCE ON ARCHAEOLOGICAL VISIBILITY

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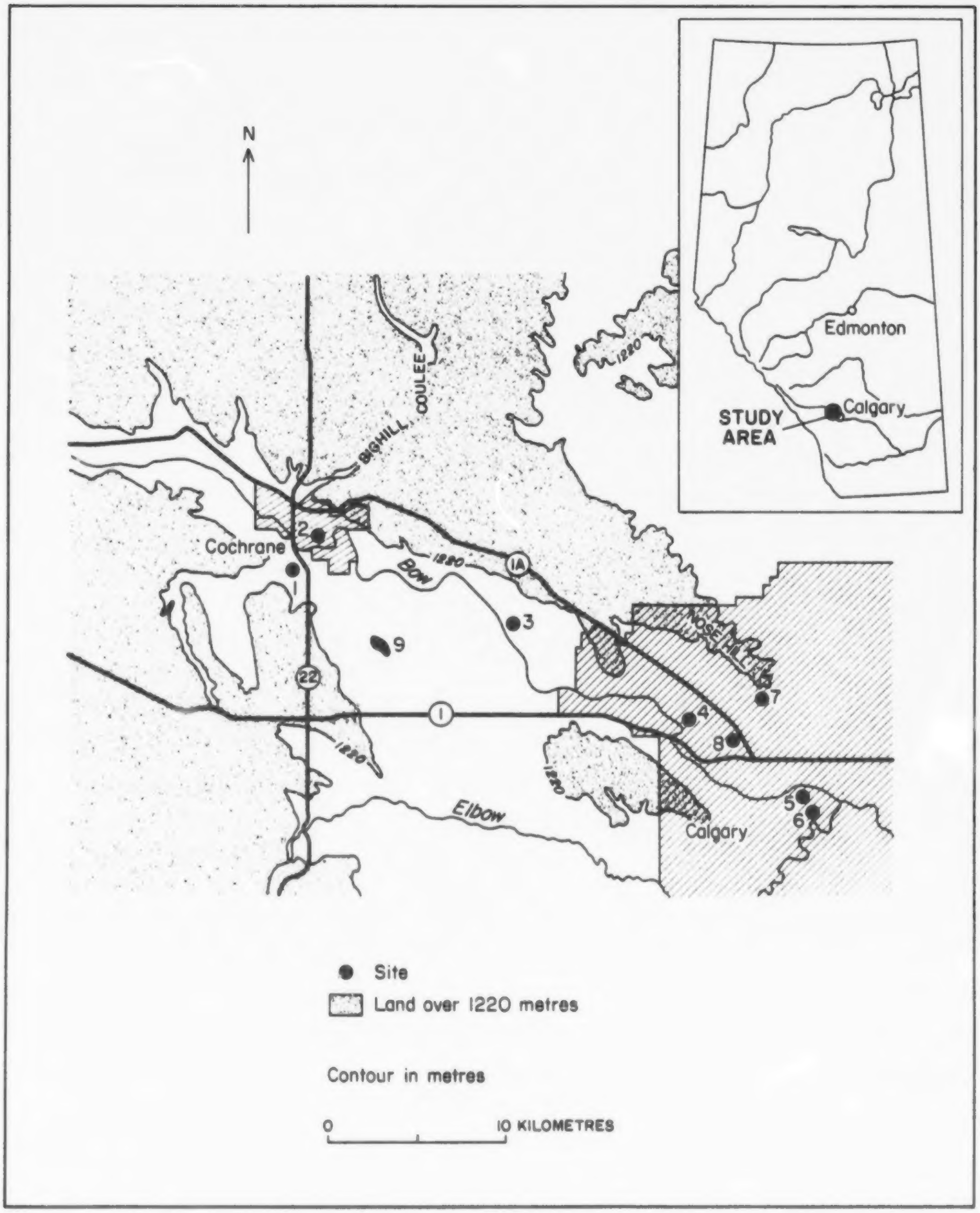
Michael Clayton Wilson
University of Lethbridge

INTRODUCTION

The interplay between geology and archaeology is nowhere more apparent than in studies of the effects of various geologic processes on the visibility of the archaeological record. Geologic processes, including many factors classed as taphonomic, operate to modify the distribution of culturally deposited debris, to delete the less preservable materials from the record, and to influence the distribution of sites in terms of the "discoverability" (the potential for their discovery). Observed patterns of distribution of sites and cultural elements in space and time can only be understood if the analysis takes into account the history of the burial environment and the history of the surrounding landscape.

Studies in the Bow River valley in the Calgary area, Alberta, have demonstrated that the post-glacial landscape modification was significant (Wilson 1983a). Thus, it is unwise to use the modern topographic setting as a basis for the understanding of palaeocultural events more than a few hundred years old. The present paper considers a variety of processes operative in the area and presents examples; it closes discussion of each with a consideration of the means we have for incorporation of such understandings into ongoing archaeological research and management.

The study area selected here is the Cochrane-to-Calgary reach of the Bow River valley (Figure 25). Most examples are drawn from the immediate Cochrane and Calgary areas, but recommendations will be made for the less heavily disturbed areas in between. The area under consideration extends approximately 40 km WNW-ESE in a straight line but includes some 60 km of river channel length (west Cochrane to southeast Calgary). In this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1
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Site
Land over 1220 metres
Contour in metres
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10 KILOMETRES

Figure 25. Map of Cochrane-to-Calgary reach of the Bow River valley, with key sites indicated.

distance, the river drops from 1116 m (3,660 ft) to 1013 m (3,325 ft), essentially 100 m/60 km or 1.67 m/km.

Cochrane lies just east of the fault line that marks the structural boundary between the Rocky Mountain Foothills and Interior Plains, so that the entire study area falls within the latter physiographic zone. The area is underlain by flat-lying Palaeocene sandstones of the Porcupine Hills Formation (Carrigy 1970). A thick blanket of Quaternary sediments drapes the valley and surrounding uplands and includes alluvium, glacial till, various glaciolacustrine sediments, colluvium, slopewash and aeolian deposits (Glendinning 1974; Harris and Boydell 1972; Harris and Ciccone 1983; Jackson 1977:, 1980; Meyboom 1961; Morgan 1966, 1969; Rutter and Wyder 1969; Stalker 1968; Tharin 1960; Wilson 1974, 1983a; Wilson and Churcher 1978).

LAKE PLAIN AND EARLY POST-GLACIAL VALLEY

In Late Pleistocene times, a proglacial lake (Glacial Lake Calgary) was formed between the Cordilleran and Laurentide/Athabascan ice masses in the Bow Valley (Harris and Ciccone 1983; Stalker 1968; Tharin 1960; Wilson 1983a). The lake, which was produced by the damming of the Bow River by ice, spilled over surrounding uplands at its highest stand when the eastern ice dam stood against Cairn Upland in west Calgary. At present, the age of the lake is unclear. Harris and Ciccone (1983) advocate a late Pleistocene to early Holocene age, with drainage by 8,145 years B.P., but numerous lines of evidence militate against this and suggest a Late Pleistocene (?17,000 years B.P. or even earlier) age (Wilson 1983a). The later deposits considered by Harris and Ciccone (1983) from a site near Cochrane (Figure 25, locality 1) are likely pond deposits from the post-Lake Calgary period on the lake plain. An analogous modern example would be Glenbow Lake, south of Cochrane (Figure 25, locality 9). Harris and Ciccone (1983) contend that Lake Calgary was dammed by rejuvenated stagnant ice that persisted in the foothills, but the direct association of Erratics Train quartzite erratics with lake sediments on the University of Calgary campus (Figure 25, locality 8) indicates otherwise. The Erratics Train was emplaced by the Athabasca lobe, deflected southward by Laurentide ice. The glaciation is variously called the Balzac, the Lochend, or the Erratics Train (see Harris and Boydell 1972; Jackson 1977; Tharin 1960; Wilson 1983a).

It is not entirely clear to what extent the silts of Lake Calgary filled the Bow Valley. At the type section of Calgary silt, the Montgomery Cliffs of northwest Calgary (Figure 25, locality 4), fully 140 feet (42 m) of lake deposits extend from present river level to the lake plain surface (Tharin 1960). Lake deposits occur at higher levels on adjacent outer valley walls, suggesting that the original fill may well have been tens of metres thicker. Thus, the present valley morphology records more than 42 and perhaps as many as 60 metres of incision since the drainage of Lake Calgary.

Inset into the lake deposits are alluvial gravels and sands of a later cycle of deposition, the Bighill Creek Formation (Stalker 1968; Wilson 1983a; Wilson and Churcher 1978). These deposits have been dated on bone between 11,300 and 10,200 years B.P. (Stalker 1968; Wilson 1983a:189), indicating drainage of the lake before this time. Gravels incorrectly referred to by Harris and Ciccone (1983) as the Bighill Creek Formation at Bearspaw (Figure 25, locality 3) are in a higher topographic setting and represent an earlier (pre-Lake Calgary) depositional cycle.

As soon as Lake Calgary drained, the Bow River began to cut through the easily eroded lake deposits to re-establish its inner valley. Before deposition of the Bighill Creek Formation, the river had cut completely down to bedrock. Large sandstone clasts eroded from tills and the lake silts (where they had been iceberg dropstones) formed a large horizon, or armour, on the river bed.

Ice in the Rocky Mountains retreated to upper valleys and cirques by 12,000 years B.P., if not earlier (Ferguson and Osborn 1981; Jackson, MacDonald and Wilson 1982; Wilson 1983a). However, conditions apparently remained cool enough for permafrost to persist, stablizing Quaternary deposits on steep slopes. After 12,000 years B.P., rising temperatures caused permafrost to melt, and a period of rapid paraglacial mass-wasting of slope deposits ensued. Debris flows choked upper valleys and raised their gradients, and coarse sediments were transported and deposited well downstream; this unit is called the Bighill Creek Formation (Jackson, MacDonald and Wilson 1982; Stalker 1968), after a type section in Cochrane (Figure 25, locality 2). The paraglacial processes waned in importance as slopes achieved stable profiles, with debris-flow activity virtually ceasing after the Mazama tephra fall (6845 ± 50 years B.P. based on numerous radiocarbon dates; Bacon 1983). Paraglacial processes were most obvious in high-gradient montane areas but were also effective elsewhere. In Calgary, large fan-like features issue from the feet of major coulees on the southern face of Nose Hill (Figure 26); despite their scale, they often exhibit Mazama tephra at only about 50-75 cm depth, indicating that most deposition was prior to the tephra fall. This tephra in the Calgary area (Figure 27) is both thick and widespread, serving as a vitally important time-marker in a variety of deposits and facilitating correlation.

In the mountains, debris-flow deposits can resemble tills, and it is of vital importance that test pits not be terminated when "tills" are reached. Deeper testing could reveal Late Pleistocene cultural material beneath the debris flows.

The present Bow valley in the Cochrane-Calgary area characteristically consists of an outer valley several kilometres across, floored by the glacial plain, and an inner valley, usually only a few kilometres across, cut through the lake deposits (Figure 26). Archaeological manifestations older than about 11,500 years B.P. would be anticipated only in the outer valley, on the lake plain or on surrounding uplands. In this connection, the location and survey of old lake beachers would be advisable. Known beach features are discontinuous as geomorphic entities (wave-cut benches in exposed locations), but in other areas they are revealed as buried shingle gravels with no surface expression. No comprehensive map is available as yet. A single cobble chopper from a Lake Calgary beach deposit in west Calgary (Wilson 1983a:331-332) may be this old but was unfortunately in an equivocal context. The beaches are elusive geomorphic features but can be recognized when transected by trenches, from which surveys could be conducted along lines of comparable elevation (see Wilson 1983a:148 for information on these elevations).

During Llano (Clovis + Folsom) times, ca. 11,500 to 10,500 years B.P., deposition of the Bighill Creek Formation was underway in the inner valley where a braided stream occupied a gravel floodplain. The nature of this rapid depositional cycle, which affected other plains drainages

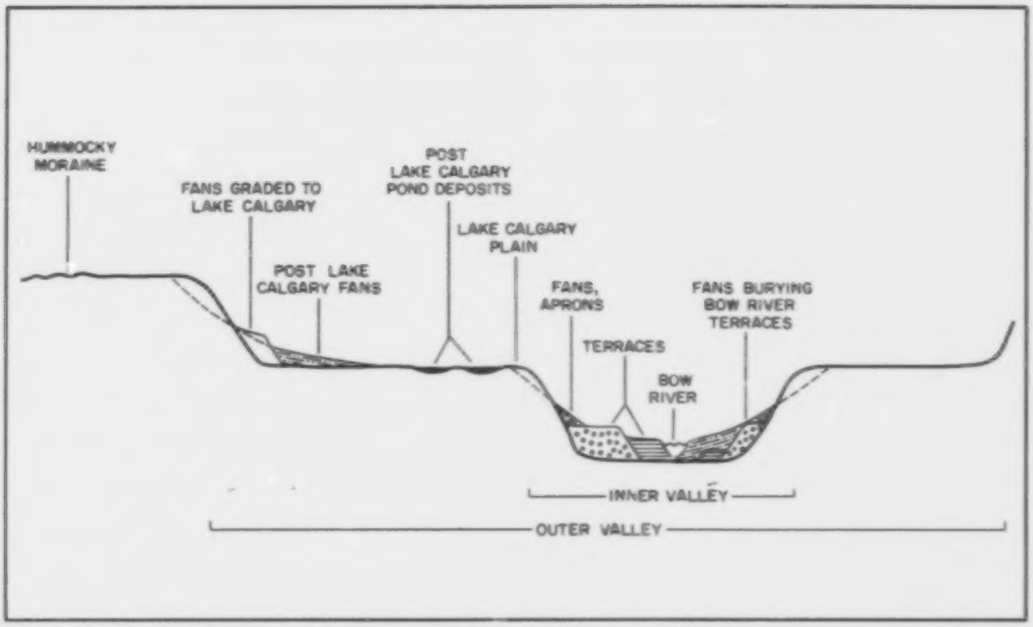

HUMMOCKY MORAINE
FANS GRADED TO LAKE CALGARY
POST LAKE CALGARY FANS
POST LAKE CALGARY POND DEPOSITS
LAKE CALGARY PLAIN
FANS, APRONS
TERRACES
BOW RIVER
FANS BURYING BOW RIVER TERRACES
INNER VALLEY
OUTER VALLEY

Figure 26. Schematic cross section of Bow valley at Calgary, showing geomorphic features discussed in text.

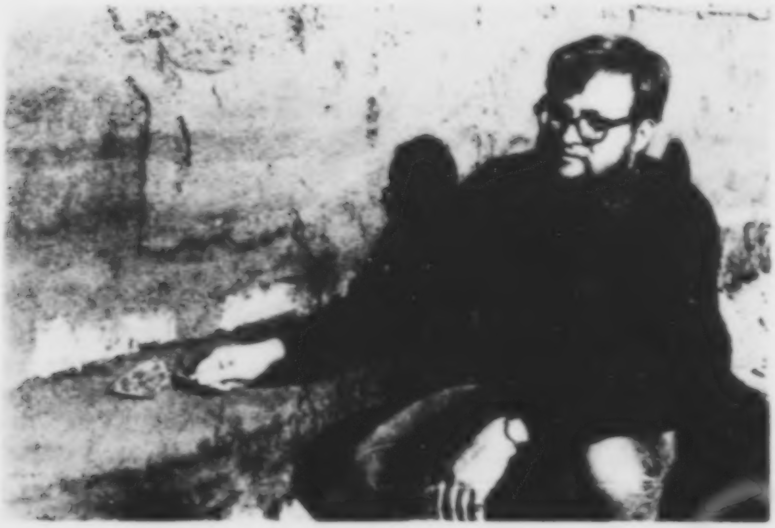


Figure 27. Mazama tephra band in T3 fill at Mona Lisa site (1968 excavations). Band is interrupted by filled rodent burrows. Note sharp basal contact.

rising in montane valleys, likely explains the paucity of inner valley Clovis/Folsom sites in Alberta despite their occurrence in nearby uplands. Surveys for such material could profitably be conducted on uplands adjacent to river valleys because large game likely tended to be more numerous near the valleys, given optimal availability of water and forage. In many areas, water remained available in hollows on the old lake plains, but valley rims would still have been important conduits for travel by virtue of being well drained. They also would have served as overlooks for discovery of large game in the valley.

While such valley-rim settings would seem susceptible to erosion by slopewash, downwind valley rims in reaches that are perpendicular to prevailing winds can be sites of significant "cliff-top" aeolian deposition (cf., David 1970; Wilson 1983a:337-338). Indeed, a Clovis point was excavated in such a setting along the east rim of the Bow valley a short distance south of Calgary, although its excavator viewed a primary occurrence as improbable (McIntyre 1975:335-337). Such areas should continue to be searched diligently for material of comparable antiquity.

Given the unstable, high-energy nature of the Bow River floodplain at this time (probably comparable in many ways with the modern Kicking Horse River floodplain near Field, British Columbia), sites are unlikely to have been preserved in this environment. However, this interval of aggradation did promote the burial and preservation of vertebrate fossils. Bones are found in the Bighill Creek Formation both as disarticulated elements (Churcher 1968, 1975) and as at least partially articulated skeletons (Wilson 1983a; Wilson and Churcher 1978). Only large ungulate bones have been recovered thus far, and some exhibit burning (Churcher 1968) as well as spiral fracturing. It is possible that a case could be made for human modification of some of these elements, and archaeologists should pay more than passing attention to these deposits.

A final possibility relating to the lake plain which should be mentioned here is the presence of wave-cut rock shelters. On the southern slope of Nose Hill in north Calgary are occasional areas where large sandstone slabs have tumbled downslope from resistant outcrops. The manner of their movement indicates that they were once overhanging ledges, in which case they would have formed the roofs of rock shelters of unknown size. The waters of Lake Calgary during its later stands lapped against this face of Nose Hill, and it is hypothesized that these standstone outcrops were initially sculpted by waves from the lake. Given that this slope of Nose Hill actually faces southwest, waves whipped up by prevailing westerly winds would have been effective in erosion. The rock shelters they cut would thus have been available for occupation shortly afterward, with only a small drop in lake level. In addition, a southwest exposure would have been attractive in terms of sunlight, although rather windy. Later, the same shelters would have looked out over the broad lake plain (Figure 28), serving as satisfactory overlooks for game. Test pits downslope from the modern in-place outcrops (allowing, of course, for Holocene retreat of the outcrops) would be of considerable interest.

In summary, early post-glacial archaeological sites are anticipated in the study area. It is recommended that searches or test excavations be made in a number of topographic settings not usually "singled out" in previous studies: (1) paraglacial fans where material probably lies beneath debris-flow diamictons resembling tills; (2) areas of bluff-top aeolian accumulation along river valley rims; (3) beaches of glacial lakes; and (4) wave-cut rock shelters along such strandlines, including examples that have since collapsed.

BOW VALLEY TERRACE SEQUENCE

Since the time of Lake Calgary drainage, the Bow River has been gently cutting down to the old bedrock valley floor, which has not yet been reached. Downcutting was punctuated in early Holocene times by periods of aggradation, so that a sequence of paired terraces is present (Figure 26). Evidence at Cochrane (Figure 25, locality 2) suggests the presence of some cut terraces which developed as fillstraths in the Bighill Creek Formation fill (Stalker 1968), but pits at Calgary reveal dated later fills inset within the Bighill Creek and therefore of lesser antiquity (Wilson and Churcher 1978). Since 5,000 years ago, the river has been very slowly downcutting, with lateral migration being sufficient to produce mappable point bar slipoff surfaces. Minor variations in rate

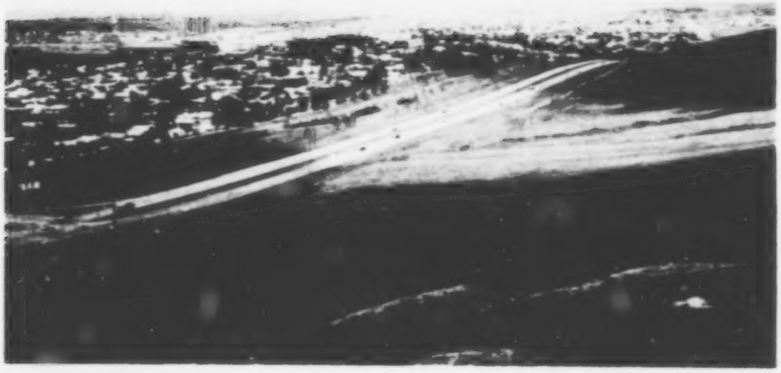


Figure 28. View SW from Nose Hill shelters to Lake Calgary plain. Sandstone blocks in foreground are collapsed rimrock from shelter. John Laurie Boulevard separates Nose Hill from developed lake plain.

of incision have left steps in these, forming unpaired terraces. Terraces of Holocene age have been numbered in chronological order T3, T2 and T1; T4 is an older surface on the Bighill Creek Formation, and T0 is the modern floodplain of annual inundation (Figure 29). Stalker's (1968) numbering system for Cochrane terraces differs and is not used here.

T3 FILL AND INCISION (EARLY-MID HOLOCENE)

Incision of T4 began after 10,200 years B.P. based on the youngest date for the Bighill Creek Formation at Calgary, from the Aquitaine Pit (Figure 25, locality 5; 10,200 ± 280 years B.P.:GSC-3065; Wilson 1983a:189). Deposition of the T3 alluvial fill began well before 8300 ± 280 years B.P. (GX-6397-A; Wilson 1983a:226), the earliest date available for the Mona Lisa archaeological site (EgPm-3; Figure 25, locality 6; Wilson 1983a:350-378) and was likely under way by 9,000 years B.P. It continued until about 5,000 years B.P. and, during the last 1000 years of this period, was marked by progressively less frequent overbank flooding probably associated with the onset of a new cycle of downcutting.

It is in the case of T3 that we see one of the finest examples of geological influence on archaeological visibility in the Calgary area.

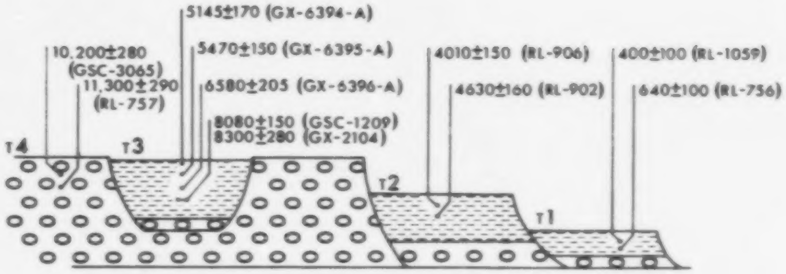

5145±170 (GX-6394-A)
10,200±280
(GSC-3065)
5470±150 (GX-6395-A)
4010±150 (RL-906)
400±100 (RL-1059)
11,300±290
(RL-757)
6580±205 (GX-6396-A)
4630±160 (RL-902)
640±100 (RL-756)
8080±150 (GSC-1209)
8300±280 (GX-2104)
T4
T3
T2
T1

Figure 29. Schematic cross section of terraces in the Calgary areas, showing cut-and-fill relationships and available radiocarbon dates, after Wilson (1983a).

The T3 fill masks a pre-existing landscape of dissected Bighill Creek Formation gravels (Figure 30). The thickness of T3 fill varies from a few centimetres to several metres in the Calgary site core alone, as shown in Figures 31 and 32. This has obvious consequences as a predictive device for discovery of archaeological materials on comparable surfaces upstream and downstream on the Bow, as well as on other comparable east slope drainages. Extensive terrace surfaces between Calgary and Cochrane have thus far escaped development and serve as prime examples (Figure 33).

One consequence of the great variations in thickness of terrace fills is that shallow shovel tests would not suffice as a survey procedure on such surface (if they do on any depositional surfaces). A 50 cm shovel test that in one area of the downtown Calgary T3 surface would strike Late Pleistocene gravels would fall short of reaching even the uppermost cultural level of the Mona Lisa site a few blocks away. A one metre deep test pit would not even reach Mazama tephra in many areas. An isopack map of thickness of deposits between surface and Mazama tephra (Figure 34) reveals the extent of the problem and the need for deep backhoe or auger tests in several areas. A time-datum contour map for the surface 50 cm below modern surface (Figure 35) reveals considerable lateral variation and shows that the total area available for artifacts of particular ages varies considerably (Table 5).

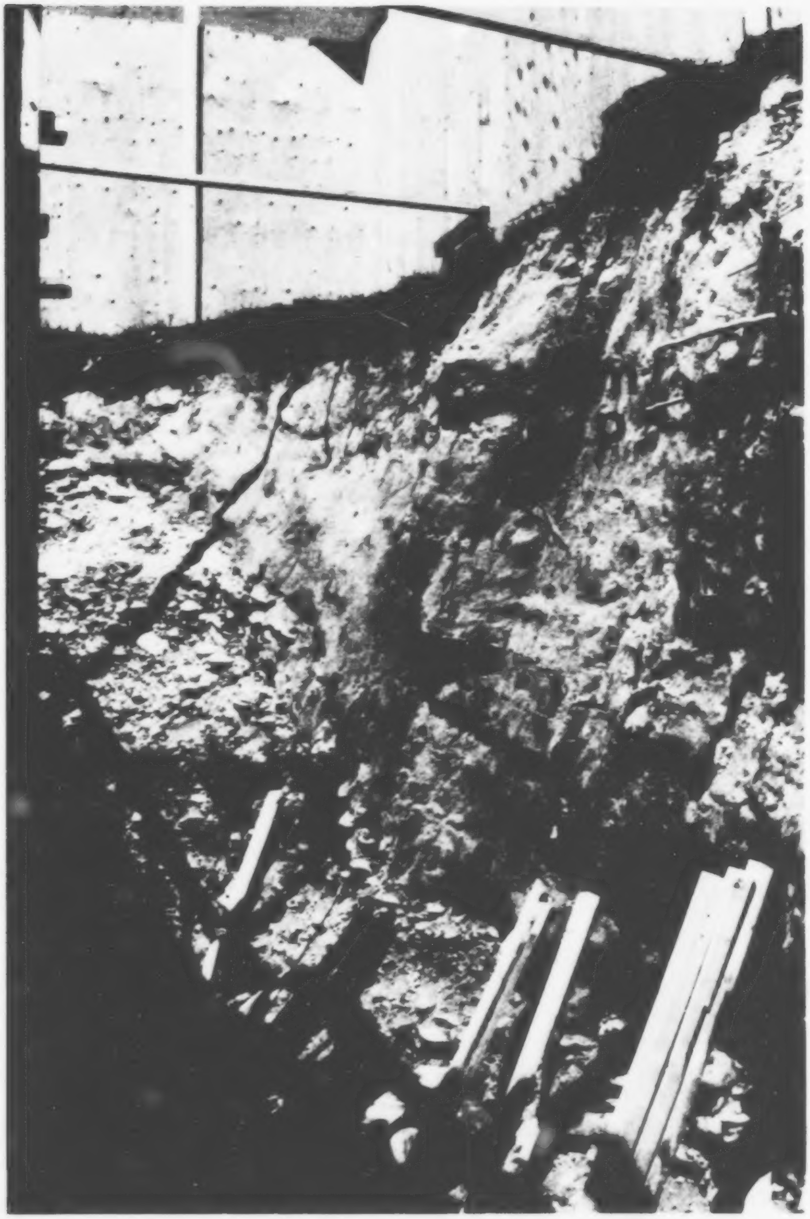


Figure 30. Basement pit at 13th Avenue and 8th Street, S.W., Calgary, showing T3 fill (ca. 3 m) inset in T4 gravels. Levels at Mazama tephra (m) and underlying palaeosol (p) are indicated.

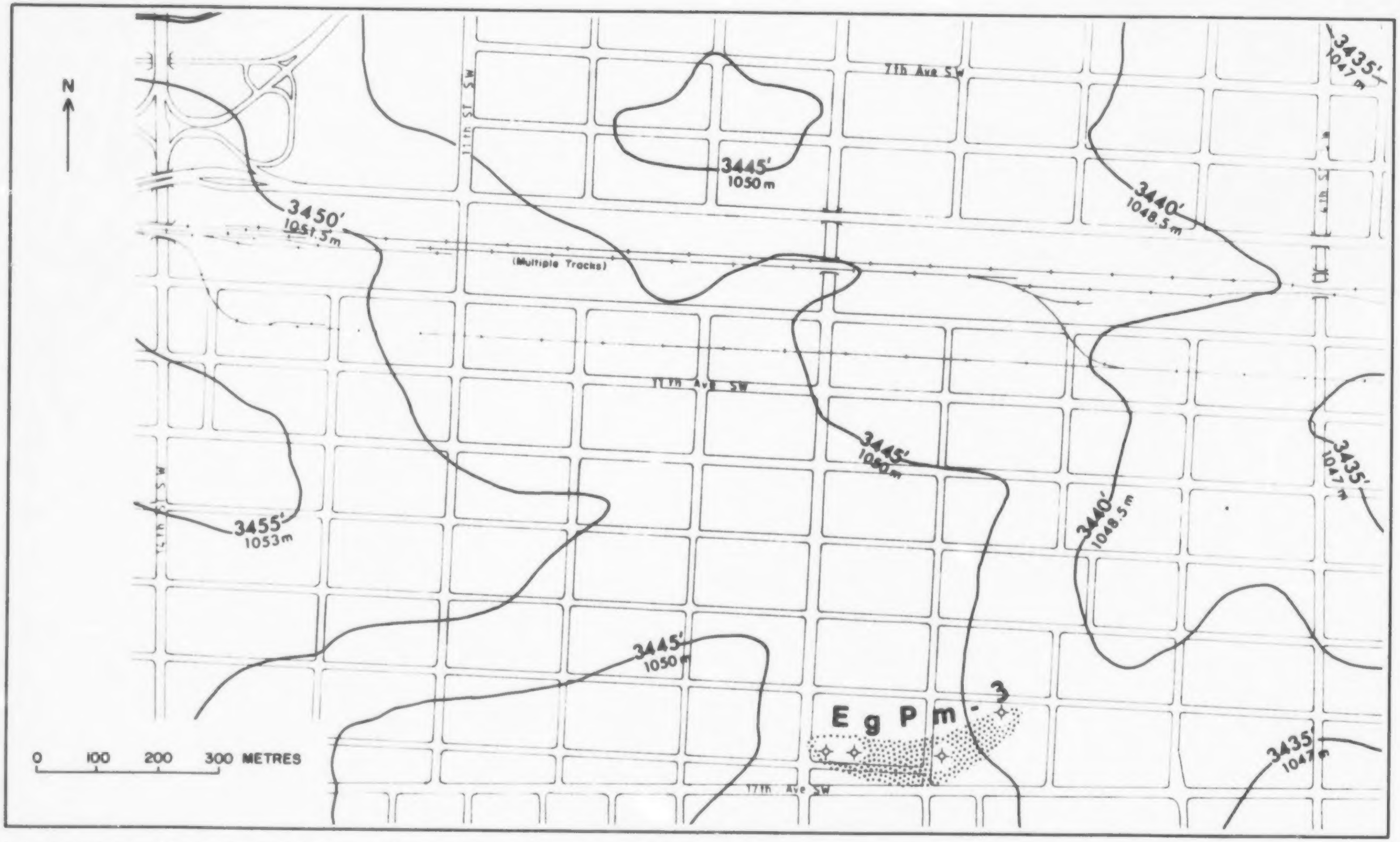

N
7th Ave SW
11th St SW
11th Ave SW
17th Ave SW
(Multiple Tracks)
3435'
1047 m
3440'
1048.5 m
3445'
1050 m
3450'
1051.5 m
3455'
1053 m
EgPm-3
0
100
200
300 METRES

Figure 31. Map of southern city core, Calgary, showing modern surface contours of elevation above sea level, adapted from City of Calgary topographic maps. At the Mona Lisa site (EgPm-3) target symbols represent sampled areas within site.

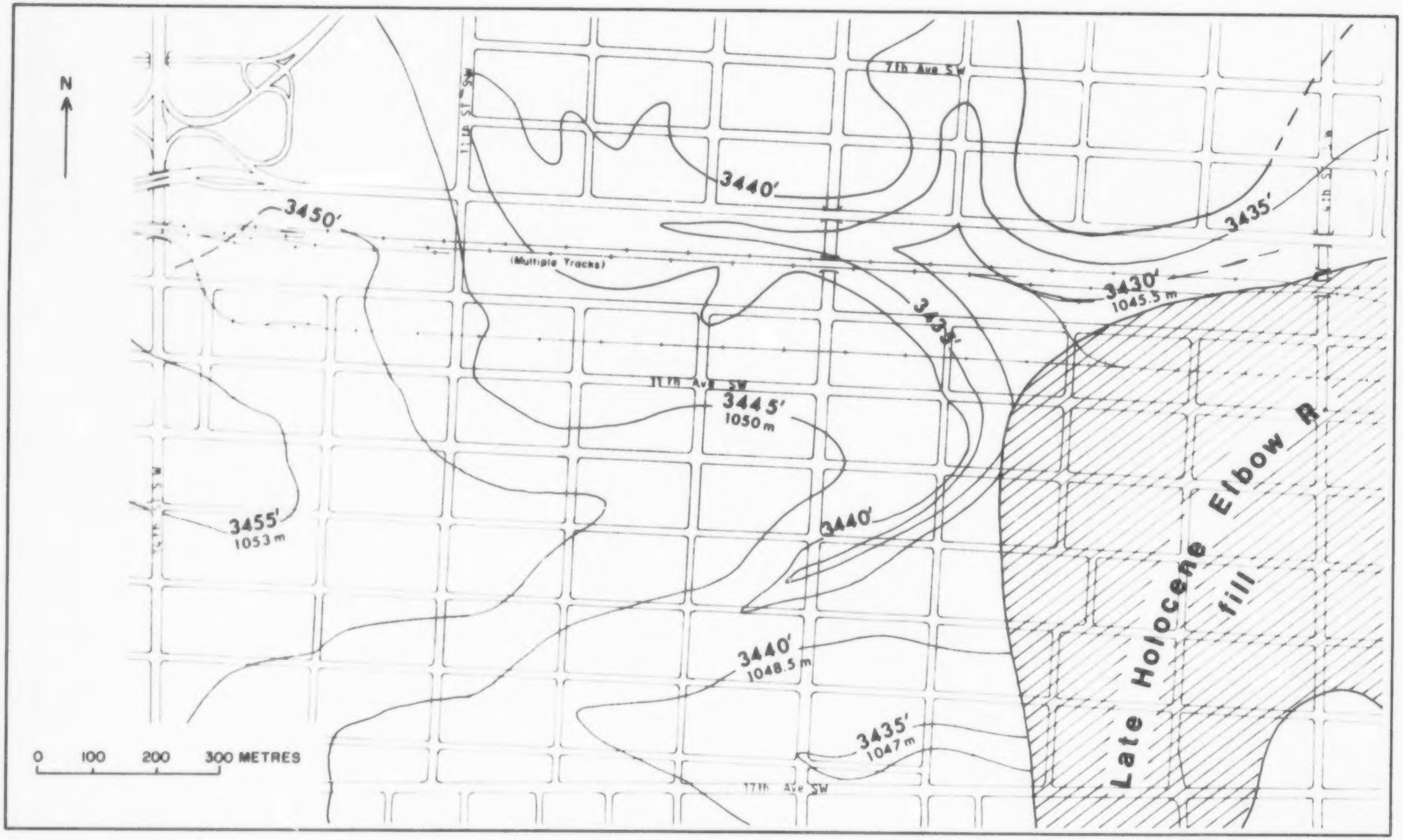

N
0
100
200
300 METRES
11th ST SW
7th Ave SW
4th St SW
(Multiple Tracks)
11th Ave SW
17th Ave SW
3450′
3455′
1053 m
3440′
3445′
1050 m
3440′
3440′
1048.5 m
3435′
1047 m
3435′
3430′
1045.5 m
3435′
Late Holocene Elbow R
fill

Figure 32. Map of southern city core, Calgary, showing contours of elevation on surface of Bighill Creek Formation gravels. In some areas gravels form the modern surface (T4); in lower areas younger fill (T3) overlies them. Cross-hatched area is a more recent Elbow River cut-and-fill cycle.

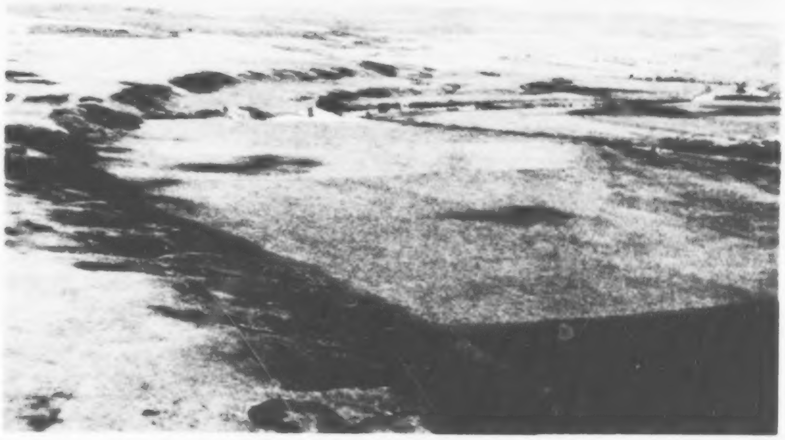


Figure 33. View of extensive flats on south side of the inner valley between Cochrane and Calgary, looking NW. Town of Cochrane is in right distance.

Experience with archaeological remains and bison bone discovered thus far in the area suggests a non-random distribution and a tendency to occur in filled "coulee" areas, based on direct observation of the walls of excavated basement pits and utility trenches (screening of backdirt was of course not possible). A map of the "potential for discovery" of archaeological remains in the area reflects this tendency (Figure 36). The reason for this localization probably reflects the fact that the floods that brought deposition to the low areas also scoured the more widespread floodplain surface. Thus, archaeological materials on the gravel plain were vulnerable to erosion, while those in the low areas were more protected. Combined with the time-datum contour map (Figure 35), this preferential distribution suggests that the chance of discovering an Early Middle Period (early side-notched point) site by conventional means in this particular area is comparatively low, even though such remains have been revealed by deep testing at the Mona Lisa site. Deep testing by backhoe or auger would seem to be the only practical, rapid means for discovery of such remains here, though carefully trowelled or shovelled deep test pits would obviously be preferable.

Given the great textural contrast between coarse alluvium of the Bighill Creek Formation and fine alluvium of the inset T3 fill, simple

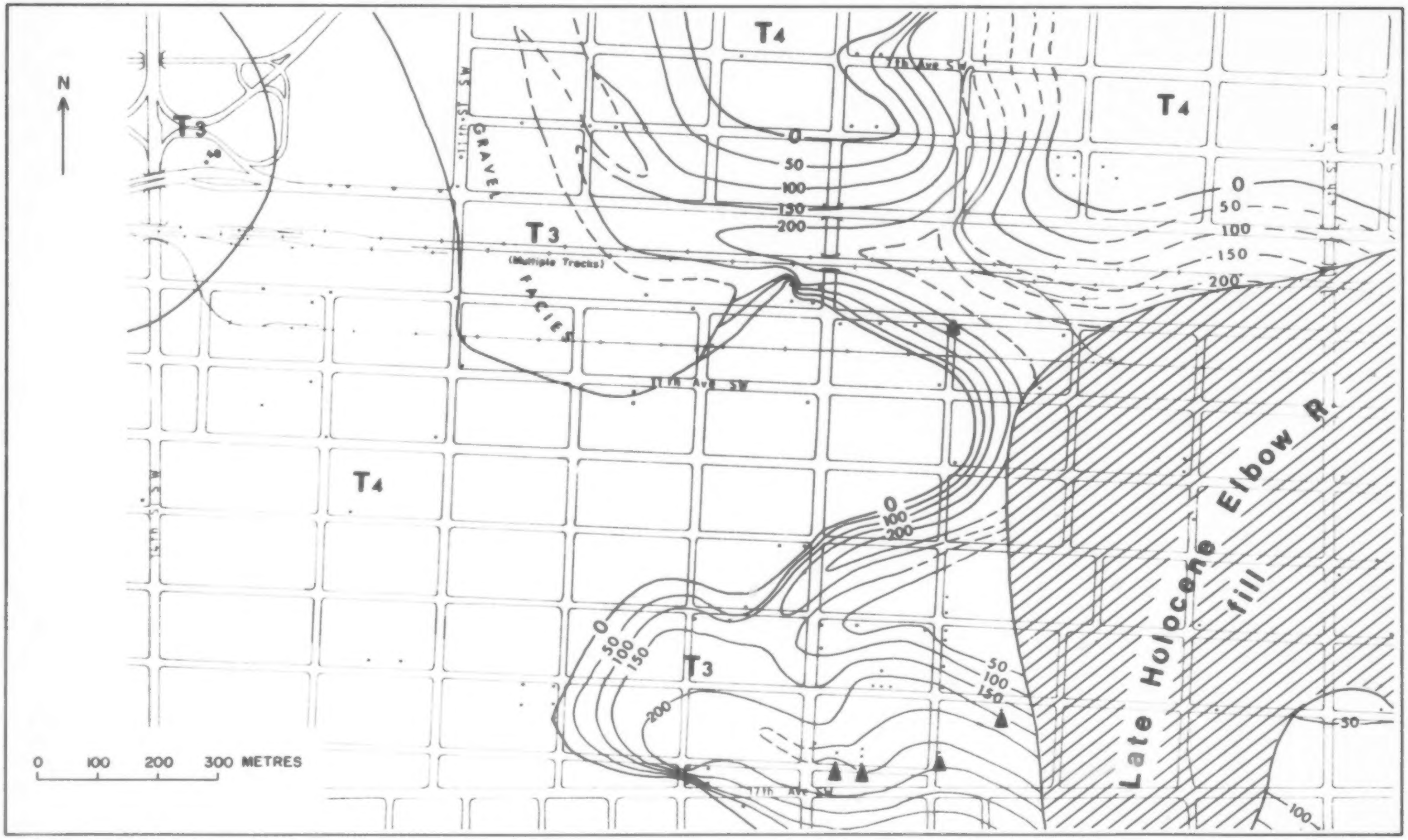
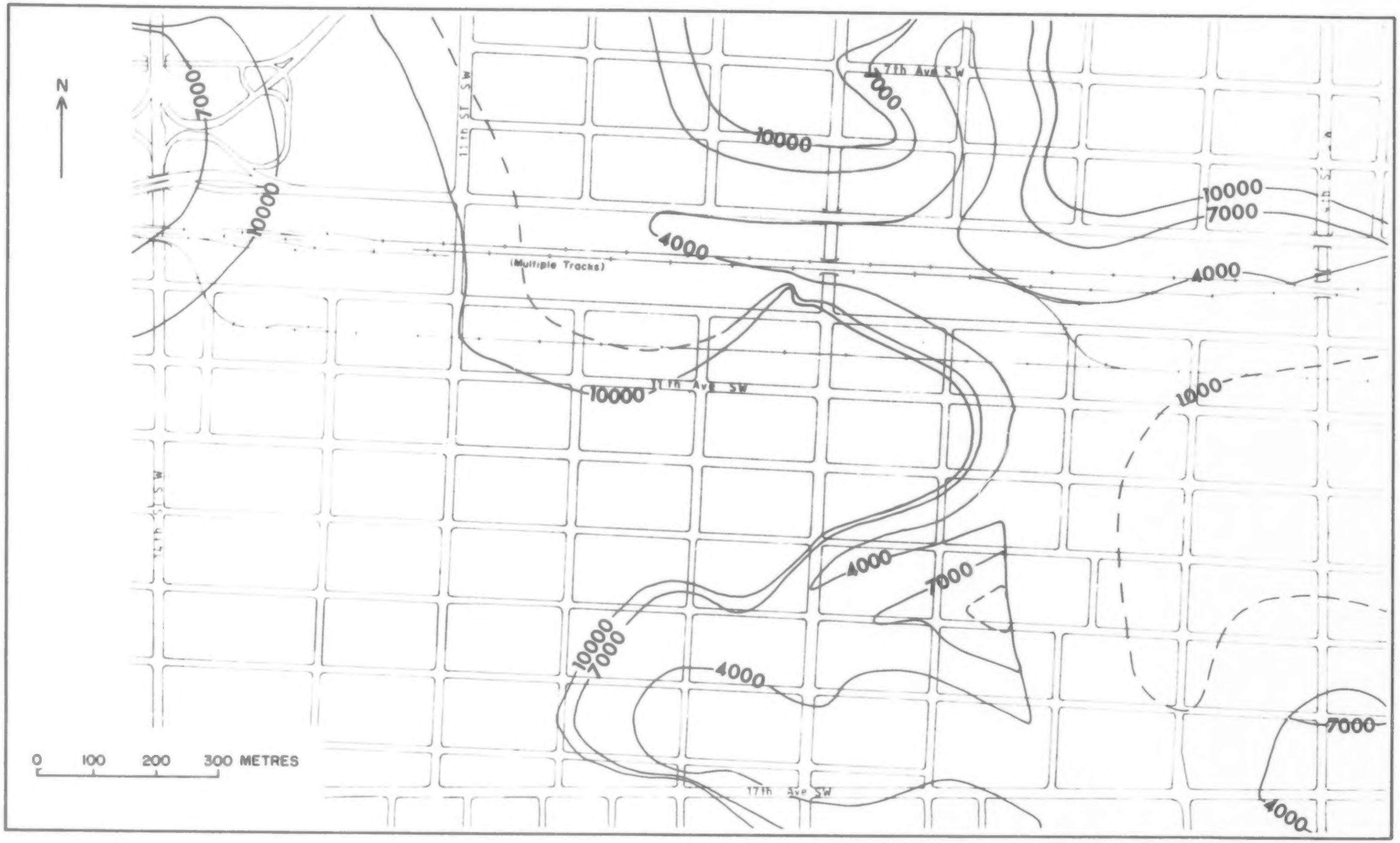

N
T3
GRAVEL
T3
(Multiple Tracks)
FACIES
17th Ave SW
T4
T4
T4
0
50
100
150
200
0
50
100
150
200
0
100
200
0
50
100
150
T3
200
50
100
150
Late Holocene Elbow R. fill
50
100
0 100 200 300 METRES

Figure 34. Isopachous map of thickness from surface to Mazama tephra in southern Calgary core. Dots record data collection points. Triangles point to discoveries of archaeological materials or bison bones.



N
0
100
200
300 METRES
7000
10000
11th ST SW
(Multiple Tracks)
10000
11th Ave SW
4000
10000
7th Ave SW
7000
10000
7000
4000
1000
4000
7000
10000
7000
4000
17th Ave SW
7000
4000

Figure 35. Time-datum contour map for the surface 50 cm below modern surface in southern Calgary core representing maximum age (in years B.P.) of artifacts to be expected in a 50 cm test pit.

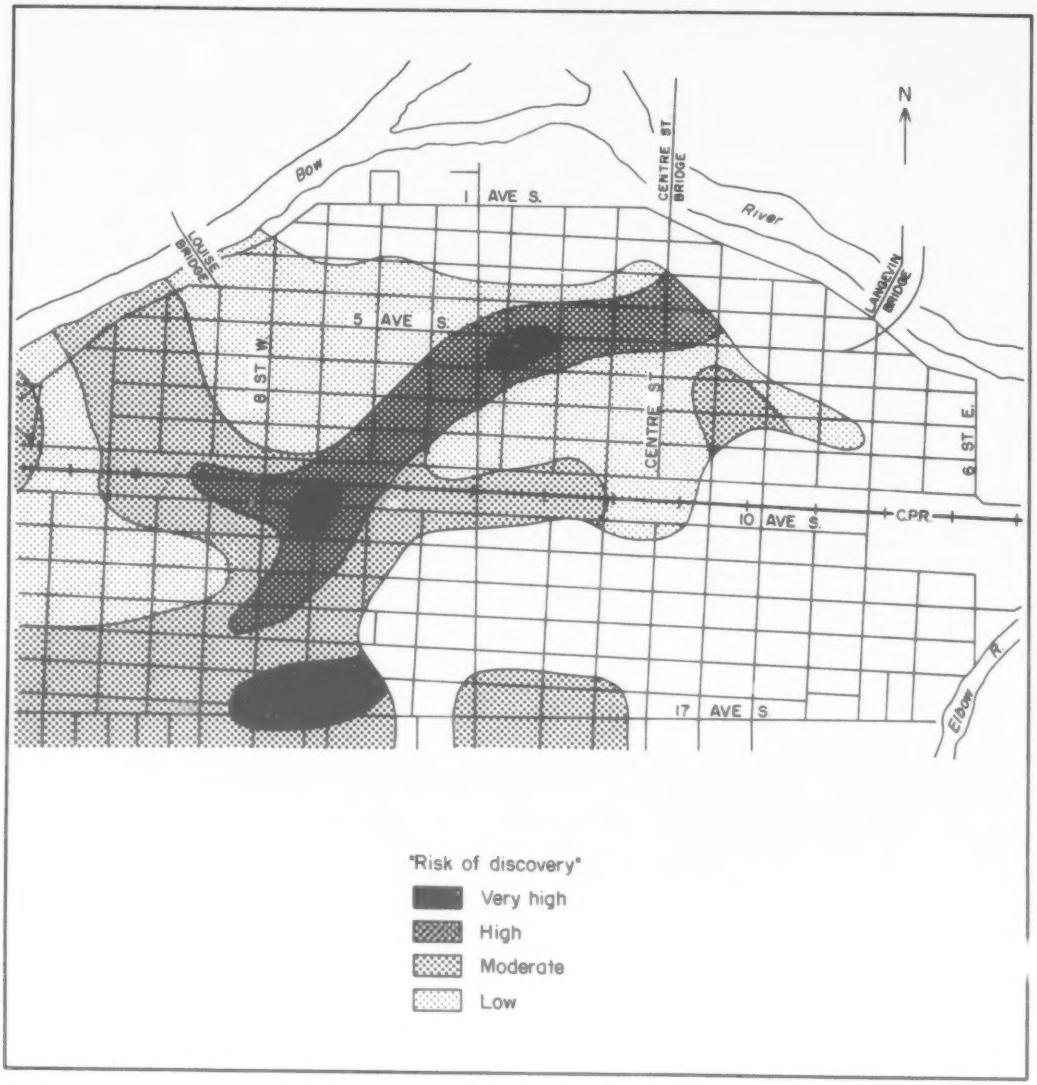

N
Bow
River
1 AVE S.
CENTRE ST BRIDGE
LOUISE BRIDGE
LANGEVIN BRIDGE
5 AVE S.
8 ST W.
CENTRE ST
6 ST E.
10 AVE S.
C.P.R.
17 AVE S.
Elbow R.
"Risk of discovery"
Very high
High
Moderate
Low

Figure 36. Map of Calgary core area showing probability of discovery of archaeological and palaeontological remains in T3 deposits, based on documented occurrences of artifacts and bison bones.

Table 5. Maximum area available for encounter of artifacts of specific ages in 50 cm deep test pits, southern city core of Calgary.[1]

AGE OF ARCHAEOLOGICAL REMAINS (YEARS B.P.)	AGE (m^2)	% OF TOTAL
1. 10,000	891,763	44.5
2. 7000 - 10,000	1,284,065	64.1
3. 4000 - 7000	1,471,864	73.5
4. 1000 - 4000	1,868,198	93.3
5. 0 - 1000	2,002,637	100.0
6. differential, 5-4	134,439	6.7
7. differential, 4-3	396,334	19.8
8. differential, 3-2	187,799	9.4
9. differential, 2-1	392,302	16.6

[1] Based on areas within time-datum contours shown in Figure 35.

[2] Much of this area has, however, been subjected to scour during floods, so that for material in excess of 4,000 years old, localization in protected areas is apparent (see text). Thus the true figure for categories 1 to 3 is probably much lower than is shown here, given deep burial in the protected areas.

seismic techniques could likely be used to map variations in depth to gravels outside the city (see Loy 1978). Use of these techniques on such an essentially featureless surface as that produced by subsequent inundation of the dissected surface of the Bighill Creek Formation (Figure 32) would greatly simplify prediction of the cost and duration of a direct testing program.

YOUNGER TERRACE DEPOSITS

Deposits of the lower (younger) terrace fills reflect deposition by overbank waters during a period marked by gentle downcutting and small-scale lateral migration of the Bow channel. These fills have basal point-bar gravels overlain by stratified silts with incipient soil A horizons developed between flood episodes (Figure 37). At present, there is little direct evidence as to the frequency of major floods at Calgary, but the similarity of many of the A horizon suggests a definable periodicity.

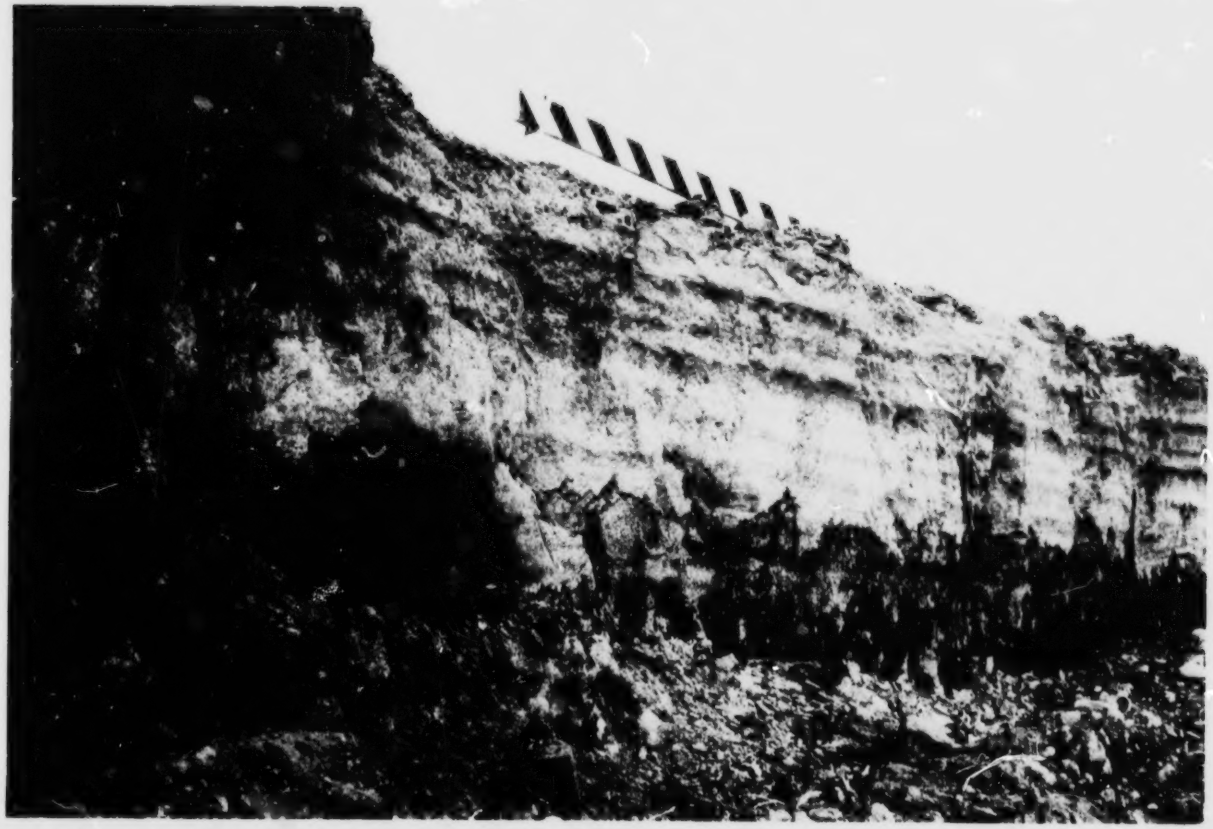


Figure 37. Wall of utility trench through T2 deposits at Point Mackay, NW Calgary (Wilson 1983a) showing stratified overbank silts with incipient soil A horizons developed between flood episodes.

The importance of these deposits to archaeologists is twofold. First, they preserve an impressive array of cultural materials ranging from butchered bones to buried stone circles to historic Fort Calgary (Wilson and Howes 1977; Wilson 1983a, 1983b); and second, they preserve evidence of the selective effect of floodwaters on distribution of various classes of cultural materials (Wilson 1983a:388-395, 1983b). It is important to note that overbank deposition in floods can continue to build up terrace deposits even while the river channel is in fact being incised.

HILLSLOPE PROCESSES

This class of deposits includes fans and aprons built outward from valley slopes by processes such as colluviation and slopewash. These deposits are not well understood by many archaeologists in this area, and their archaeological potential is only beginning to come to light.

Colluvial/alluvial fans are found in a wide variety of valley-wall settings, ranging from the inner valley to the walls of the outer valley (for example, Nose Hill). They are generally built outward from gullies or coulees cut in the slopes. A few are associated with minor springs, but most only carry significant amounts of water at the time of snowmelt, when some alluvium is doubtless deposited. Further deposition comes from the action of unchanneled water (sheetwash) on flanking slopes during rainstorms, as has been hypothesized for the fill of Bighill Coulee (Figure 25) north of Cochrane (Osborn 1977). Where coulees have already been established, unchanneled waters bring sediments down to the upper portions of the fans, while on valley slopes away from the coulees aprons are built out from the slope base.

Along the south face of Nose Hill (the north outer valley wall), major fans issue from coulees onto the old Lake Calgary plain (Figure 38). These fans may have begun to form when the lake was still present, but they certainly continued to grow in Holocene times. The author has observed bands of Mazama tephra at about 50 cm depth in the

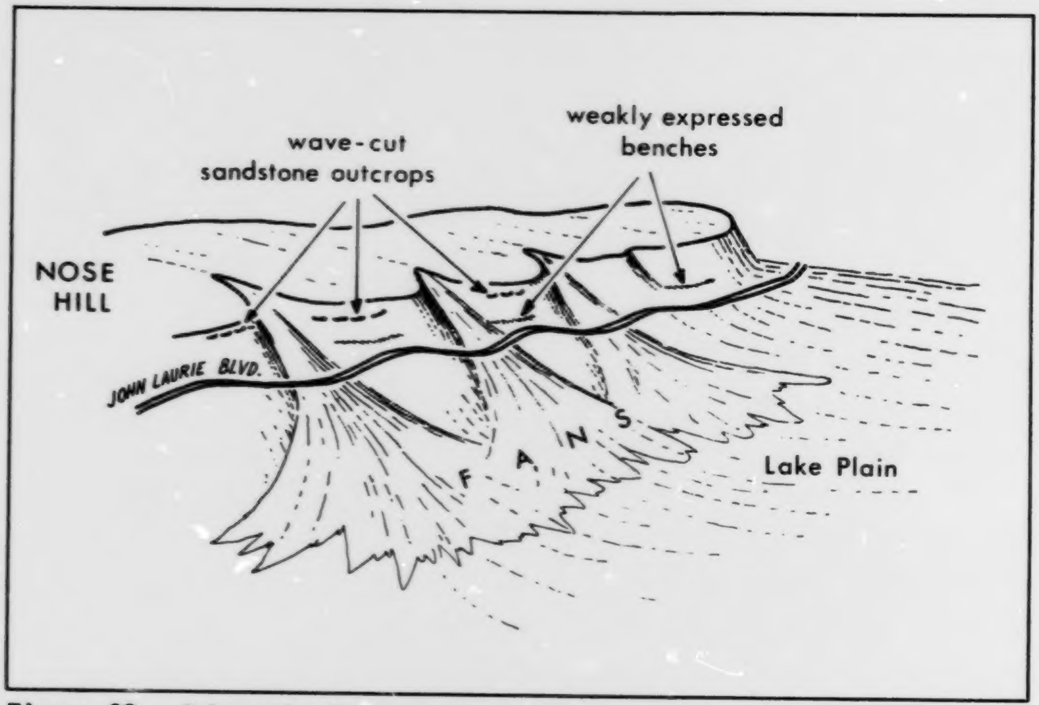


Figure 38. Schematic diagram of major fans issuing from coulees on south side of Nose Hill onto Lake Calgary plain in north Calgary. John Laurie Boulevard is included for reference.

Brentwood-Dalhousie districts of northwest Calgary, adjacent to Shaganappi Trail. The ash dips with the same gradient as the modern fan surface and indicates that most of the deposition occurred in early Holocene times or earlier. Very likely the same paraglacial processes already described for mountainous areas to the west were effective here as frozen sediment on Nose Hill thawed under warm early pos-tglacial conditions. Early post-glacial cultural remains on the old lake plain could, in such a setting, be buried under a great thickness of fan deposits. However, a mammoth tusk has been found at one locality (Northmount Drive and 14th St. NW; Figure 25, locality 7) at an unspecified depth in a shallow basement excavation (Wilson 1983a:331-334).

The development of aprons has been significant along the walls of inner valley (Figure 26) because of the availability of easily eroded silts upslope. In the West Hillhurst area of Calgary, for example, the author has observed Mazama tephra dipping at angles up to 10°. The ability of the tephra to persist on such slopes could reflect entrapment in vegetation, but cover during the Altithermal may have been less effective than today, in which case another mechanism, such as rapid burial, must be sought. Encroachment of these apron deposits over valley floor terrace surfaces certainly would have resulted in deep burial of any archaeological materials near the valley walls. Depth of burial could reach several meters.

TRIBUTARY FANS

The fans and aprons considered to this point have shown reduced rates of deposition after the time of the Mazama tephra fall. However, other fans do exist that exhibit significant thicknesses of later Holocene sediments. Those presently known to the author are associated with tributary springflow and thus with considerable amounts of water on a permanent rather than seasonal basis. A fine example is present in northwest Calgary on the south side of the valley and is the site of Edworthy Park. The Edworthy Fan (Wilson 1983a:265-269) is the product of headward cutting of a springfed tributary over the last few thousand years, and deposition has been sufficiently rapid to displace the Bow river northward (Figure 38). In recent years, the tributary flow has been contained in storm sewers, with the result that deposition has ceased, and the Bow River is able to cut into the toe of the fan. Exposures here range up to 2 m in depth and show the lensing gravels and sands typical of an alluvial fan, as well as scattered bison bones.

Figure 38 shows both the fan and a detailed section that was temporarily available during storm sewer trenching. Bison and wapiti bones were encountered at several points in a variety of horizons and included a male bison skull 3.6 m (12 ft) below the fan surface. The skull, which was small, was radiocarbon dated to 1560 ± 120 years B.P. (A.D. 390:RL-904; Wilson 1983a:267). Evidence for cultural modification of the bison remains is limited and, applying the rigorous criteria demanded by Binford (1981:320), we must class almost all of them as modified by scavengers and weathering. In some, scavenger activity is obvious, but the presence of such evidence does not rule out a cultural context as well. Dogs in prehistoric campsites no doubt routinely processed a significant percentage of the culturally selected bone sample. Edworthy Fan is listed as an archaeological site (EgPm-118) on the basis of the bone occurrences, but its chief importance to archaeologists is as an example of certain geologic processes.

Perhaps the most important lesson to be learned from the Edworthy Fan is that such features could be built out over pre-existing and quite unrelated geomorphic surfaces. The sewer line sections (Figure 39) revealed that the fan was built out over two terraces of the Bow River inner valley set described above. Each of these terrace surfaces was available for human occupation for as many as several thousand years before fan encroachment. In contrast, the fan surfaces available for occupation were only stable for a few hundred years at the very most, given the radiocarbon evidence for rate of deposition. Thus, as considerable thickness of beds representing fewer than 2,000 years and probably containing archaeological components well-separated stratigraphically (and little mixed, if at all) overlies two terrace surfaces, each of which could display "lumped" or mixed components from periods of hundreds or even thousands of years. Similar relationships are likely to be seen in many Alberta tributary fans of relatively recent construction. Obviously, deep testing is necessary simply to allow access to buried unconformity surfaces predating the fans, and possibly possessing archaeological remains.

CONCLUSIONS

Consideration of a variety of examples from the Cochrane-Calgary reach of the Bow River valley makes it clear that many archaeological components lie well beyond the reach of simple shovel tests. Deep burial presents a serious problem as to the practical visibility ("discoverability") of these remains because the Bow River has engaged in only limited lateral cutting over the past several thousand years. Many of the deposits considered here - including the deep T3 fills, the inner valley wall aprons, and the tributary fans - are inadequately represented in river cuts and thus must be sampled by excavation.

Obviously, the alternatives presented for testing are more expensive than shallow shovel testing. One alternative, the use of a backhoe, has the advantage of being rapid; however, walls must still be inspected

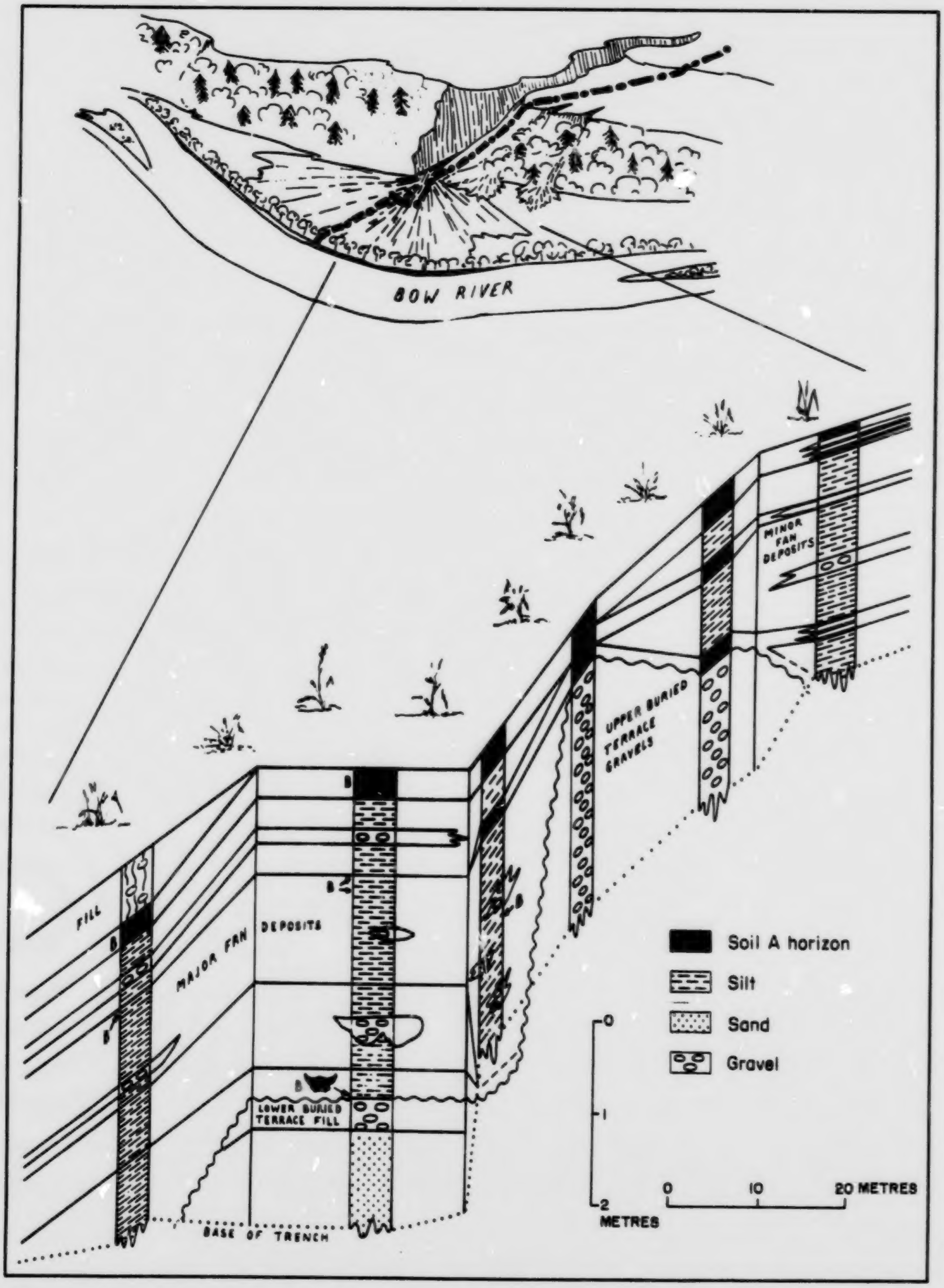

BOW RIVER
FILL
B
MAJOR FAN DEPOSITS
LOWER BURIED TERRACE FILL
BASE OF TRENCH
UPPER BURIED TERRACE GRAVELS
MINOR FAN DEPOSITS
Soil A horizon
Silt
Sand
Gravel
0
1
2
METRES
0
10
20 METRES

Figure 39. Edworthy Fan (S. side of the Bow valley, SW Calgary, looking SE) showing storm sewer trench (dashed line); relationships of strata encountered (enlargement); unconformity between terrace fills and overlying fan deposits (wavy line).

closely, and this, at times, can be dangerous. Backhoes do not produce clean walls, so preparation by trowel is still desirable. Work with a backhoe requires an experienced "eye" and is not easily accomplished by the general survey archaeologist on a "sometime" basis. Another drawback is that backdirt cannot be screened by levels for recovery of otherwise "invisible" remains. Backhoe testing has proven effective in conjunction with several recent projects, including the Mona Lisa site (Wilson 1983a) and important localities in hummocky moraine on Nose Hill (Figure 26) where otherwise undetected components were found (Reeves et al. 1981).

The alternatives are auger testing, which has depth limitations, or excavation of deep test pits, which (as noted earlier) would require shoring. Their advantage would lie in the controls afforded by use of excavation levels and screening of backdirt. Their main disadvantage, apart from safety (and they would likely be safer than backhoe trenches), would be the time required for excavation, even if by shovel.

Adequate incorporation of geological understandings and development of an acceptable approach to deep testing will doubtless require some time. However, continued ignorance of deep burial possibilities and the persistence of shallow shovel testing and inspection of natural exposures, such as riverbanks, would virtually ensure that the Alberta archaeological sample would remain strongly biased. This bias would maintain the under-representation of material from certain time periods as well as of specific site classes. Stratified sampling procedures based on physiographic or other criteria derived solely from surface observations cannot be effective if such strong biases exist within and across the sample strata.

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OBSIDIAN SOURCE ANALYSIS FOR BANFF AND JASPER NATIONAL PARKS, ALBERTA

By
Malcolm James
Parks Canada, Western Region

INTRODUCTION

Obsidian samples recovered from five prehistoric sites in the Canadian Rockies have been subjected to X-ray fluorescence (X.R.F.) analysis in order to determine their sources of origin. The energy dispersive X.R.F. analysis measures trace elements within a given obsidian sample by bombarding it with photons and measuring the characteristic X-rays emitted using a Si (Li) spectrometer (Nelson et al. 1975). The trace element content of most obsidian sources is uniform or exhibits patterned variation which produces a characteristic "fingerprint" when submitted to X.R.F. analysis. Even flows from separate volcanic events at the same source may have characteristic fingerprints. Results of the non-destructive X.R.F. technique do not vary with the size or shape of the sample and are semi-quantifiable.

Two sites from the Bow River valley in Banff National Park and three sites in or near the townsite of Jasper in Jasper National Park have produced obsidian artifacts (Figure 40). Since there are no known obsidian sources within the Canadian Rocky Mountains, the presence of obsidian detritus at these sites indicates that some form of cultural interaction took place with areas to the south or west where obsidian sources occur and are known to have been exploited prehistorically.

METHODOLOGY

Following the procedures recommended by Nelson et al. (1975), the samples were run for ten minutes each at an energy level of 35 kVs and a dead time of 15 percent. A silver target was used to provide an array of trace elements with atomic weights between those of potassium (K) and niobium (Nb). Of these elements, both the K-alpha and K-beta X-ray

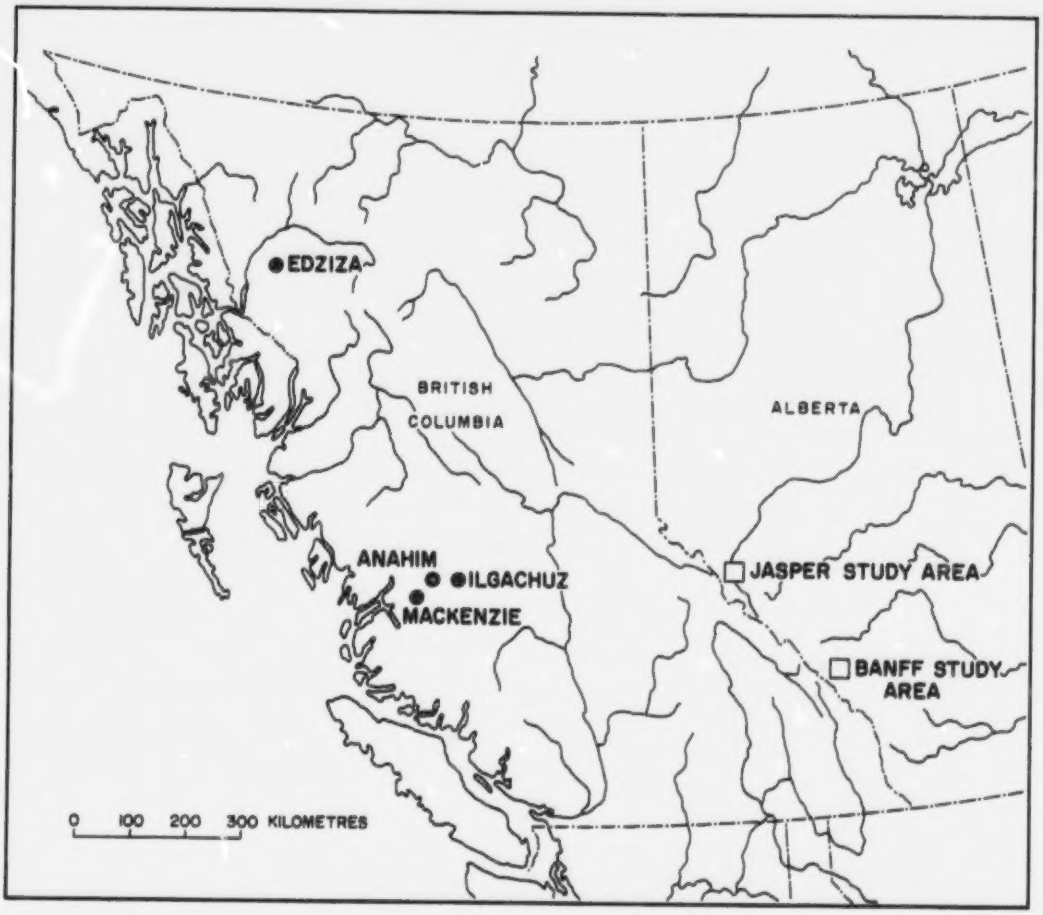

EDZIZA
BRITISH
COLUMBIA
ALBERTA
ANAHIM
ILGACHUZ
MACKENZIE
JASPER STUDY AREA
BANFF STUDY AREA
0 100 200 300 KILOMETRES

Figure 40. Major obsidian sources in British Columbia.

emissions appeared on the graphic printouts; however, only the K-alpha emissions were used for trace element identification. The most significant trace elements identified were iron (Fe), zinc (Zn), galenium (Ga), arsenic (As), krypton (Kr), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr) and niobium (Nb).

RESULTS

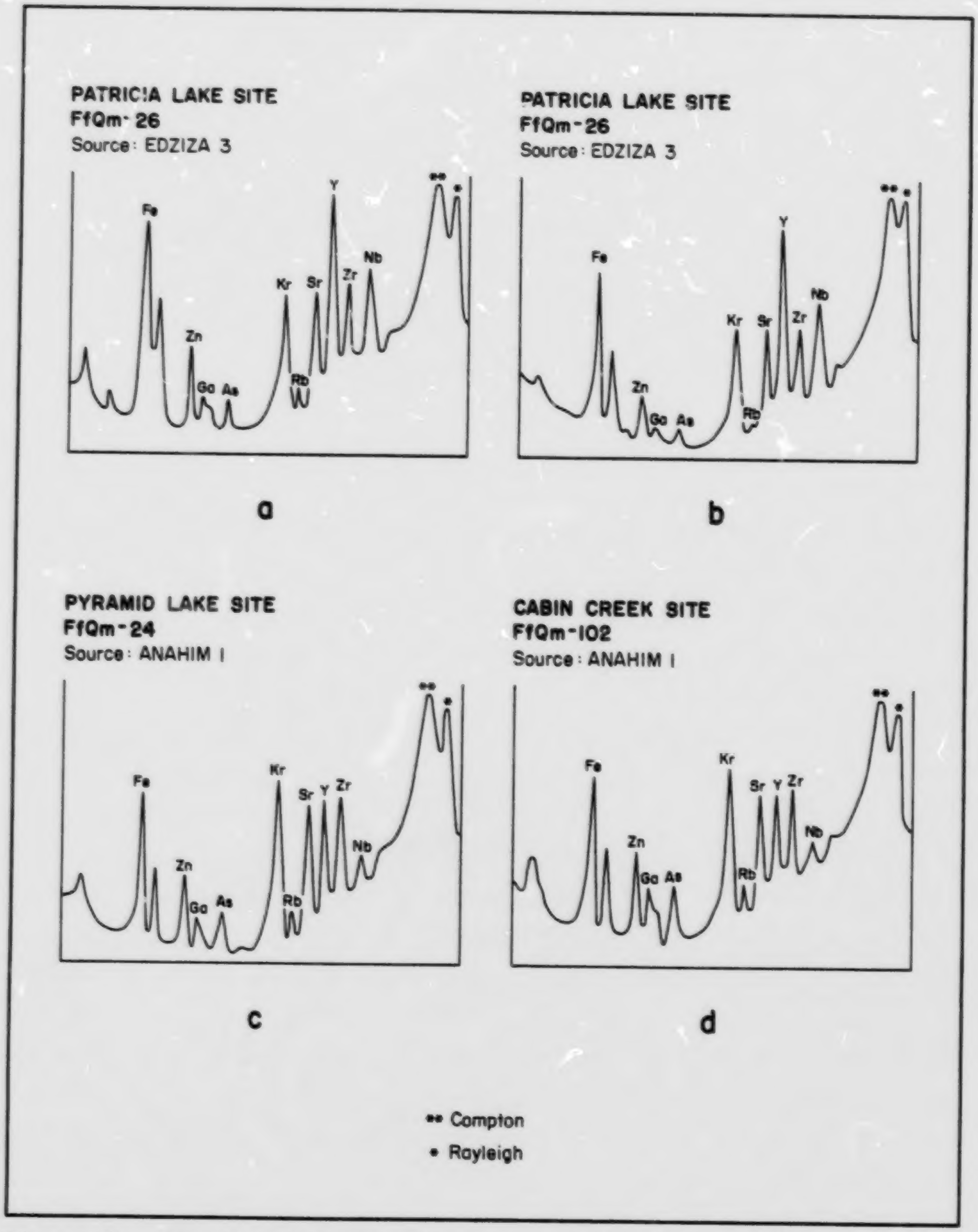
JASPER NATIONAL PARK

Two flakes of obsidian detritus were recovered from the Patricia Lake site (FfQm-26) in Jasper National Park. One flake was found during the 1983 testing of the site (Head 1983:18) and the other during the 1984 test programme (Pickard 1985). The Patricia Lake site, located at the north end of the lake on a till-mantled knoll, is heavily bioturbated and lacks cultural stratigraphy. Several diagnostic artifacts suggest cultural affiliations with the Interior Plateau region of British Columbia (e.g., large stemmed and small stemmed projectile points, a microblade core, obsidian and basalt detritus) at a period post-dating 4,000 years B.P. Other technologically diagnostic artifacts suggest cultural affinities or interactions with the Middle and Late Prehistoric assemblages of the Plains culture area to the east. It is possible, however, that the site was occupied even earlier. A Lusk-like point discovered at an adjacent site across Pyramid Lake Road (lower than FfQm-26) indicates that the area may have been occupied from 7,500 to 8,000 years B.P. until the Late Prehistoric Period.

The results of the X.R.F. analysis (Figures 41a and b) of the two obsidian samples indicate that both came from Flow #3 on Mount Edziza, British Columbia, more that 950 linear kilometres from Patricia Lake. Both obsidian flakes are black with translucent grey banding and may be by-products of a single piece of imported obsidian. Since one flake is an edge-retouched secondary reduction flake and the other is the proximal half of a pressure flake, several later stages of reduction and/or rejuvenation apparently were carried out on-site.

The source of the obsidian from the Patricia Lake site differs from obsidian found elsewhere in the Pyramid Bench area and nearby Jasper townsite. An obsidian flake from FfQm-24 (Figure 41c) at the north end of Pyramid Lake (Head 1983) and a large corner-notched projectile point from FfQm-129 (Figure 41d) on Cabin Creek at the foot of the Pyramid Bench riser (Pickard and James 1986) were both sourced to the Anahim #1 source. These artifacts are a translucent dark green colour. The point does not directly conform to any known projectile point types but may represent a reworked Thompson Phase (ca. 2,500-1800 years B.P.) point type from the Interior Plateau area of British Columbia (see Richards and Rousseau 1982).

The presence of obsidian from these two sources suggests far-reaching trade or transport networks that extend 480 linear kilometres to the Anahim Peak source and over 950 linear kilometres to the Mount Edziza source (Figure 40). The tentative identification of the obsidian point



PATRICIA LAKE SITE
FfQm-26
Source: EDZIZA 3

PATRICIA LAKE SITE
FfQm-26
Source: EDZIZA 3

PYRAMID LAKE SITE
FfQm-24
Source: ANAHIM I

CABIN CREEK SITE
FfQm-102
Source: ANAHIM I

Figure 41. Results of X-ray fluorescence (X.R.F.) analysis.

as a reworked Thompson Phase projectile point and the fact that obsidian acquisition routes pass through the northern and central interior regions of British Columbia suggest that ideas, and perhaps even populations, were accompanying raw material and finished products from the B.C. Plateau into the Rockies.

BANFF NATIONAL PARK

Obsidian was discovered at three sites within the Trans-Canada Highway Corridor in 1983 as a result of a highway development mitigation project. Most obsidian found in the area is concentrated within the Late Middle and Late Prehistoric Period components (Fedje, personal communication 1986). At the request of Fedje, samples of obsidian detritus from two of these sites were sourced. These included two samples from the Vermilion Lakes site (EhPv-8) and one from the Five Mile Creek site (EhPv-7). Both sites are located in the Bow River valley, 4.5 to 5 km west of Banff townsite.

EhPv-8 is incorporated into an alluvial fan deposit on the north side of the Trans-Canada Highway. Obsidian comprises less than 3 percent of the total Late Prehistoric lithic assemblage and represents secondary thinning and shaping stages of tool production and/or maintenance (Fedje, personal communication 1986). Most of the obsidian was clustered within the deposits, and all appeared similar in colour (opaque black), lustre and texture. While appearances suggest that all the obsidian is from the same source, the range of colours and textures possible within a single source and similarities that occur between sources make appearance alone a poor criterion for source identification. The two EhPv-8 samples analyzed both originate from a source in Yellowstone National Park (actual flow unknown) in northwest Wyoming, over 830 linear kilometres distant (Figures 42a and 42b).

Sixteen flakes of obsidian debitage were found at the Five Mile Coulee site (EhPv-7), representing 0.2 percent of the unstratified assemblage. Only later stages of lithic reduction and/or maintenance are represented (Fedje and White 1984). Given the limited stages of production represented, the close spatial and stratigraphic association, and the lack of apparent visual distinctions to suggest different

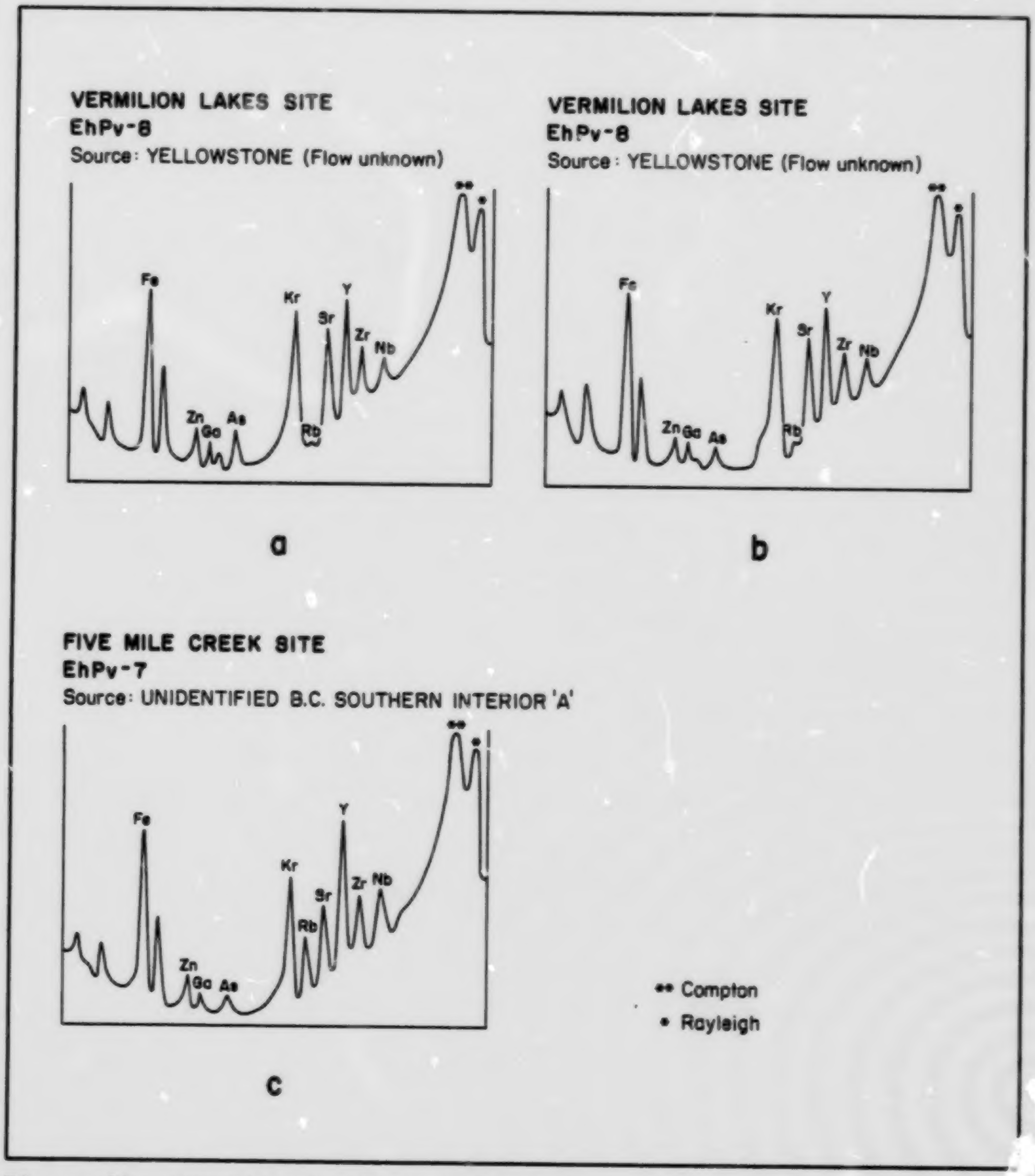


Figure 42. Results of X.R.F. analysis.

obsidian sources, it is assumed that the final stages of production of a single piece of obsidian are represented in the assemblage. As a result, only one sample was tested. The single obsidian sample analyzed from the Five Mile Creek site (Figure 42c) has been classified as originating from a source known as "unidentified B.C. Southern Interior 'A'" (Godfrey-Smith 1986). This lithic material type was exploited by the aboriginal inhabitants of south-central British Columbia but may well originate from the northwestern United States (Godfrey-Smith, personal communication 1985).

SUMMARY

Although sample sizes from both Jasper and Banff are very small (a total of seven samples from five sites in both parks), the evidence suggests that different obsidian acquisition and/or trading patterns were being used. The sources of the Banff samples were Yellowstone Park, Wyoming (two samples) and "B.C. Southern Interior 'A'" (Godfrey-Smith and D'Auria 1984) (one sample). In contrast, the Jasper sources are from Mount Edziza and Anahim Peak, British Columbia.

While there may eventually prove to be a large amount of overlap between the sources exploited by the inhabitants of both parks, the small sample to date suggests that the prehistoric groups from Banff were trading preferentially to the south and southwest, while the natives of Jasper were trading to the west and northwest. These patterns may have interesting implications for future research into the ethnicity and interrelations of the prehistoric inhabitants of the Rocky Mountains and the neighbouring regions of Alberta and British Columbia.

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AN ARCHAEOLOGICAL ASSESSMENT OF THE PATRICIA LAKE SITE
JASPER NATIONAL PARK

By

Rod Pickard

Parks Canada, Western Region

INTRODUCTION

The Patricia Lake site (FfQm-26) was located in July of 1983 during a historical resources impact assessment of the Pyramid Lake Road and Patricia Lake day use area in Jasper National Park (Figure 43). The site was identified by Thomas Head on the basis of cultural material (104 lithics and fire-broken rock) found in eleven of fifteen judgmental shovel tests over an area of approximately 20,000 square metres on the northeastern end of Patricia Lake. The abundance and nature of cultural material indicated that the site was potentially of some significance and would require further assessment in the event of highway-related disturbance.

During the summer of 1984, road improvements commenced on the lower sections of the Pyramid Lake Road. The Archaeological Research Unit of Parks Canada determined that an intensive field assessment of the Patricia Lake site should be carried out. The research design and field work were implemented accordingly during a four week period from August 17 to September 15, 1984. This report presents the results of the assessment studies.

The study area is situated on the north end of Patricia Lake, 2.5 km northwest of Jasper townsite (Figure 43). This area is commonly referred to as the Pyramid Bench. The Pyramid Lake Road extends from the townsite upslope to Pyramid Lake, bypassing the study area on the northeastern end of Patricia Lake. The site is located on an undulating till-capped bedrock ridge 5 to 10 m above the northeastern shore of Patricia Lake (Figure 44). The forest vegetation is dominated by aspen (Popular tremuloides), with lesser amounts of white spruce (Picea glauca) and lodgepole pine (Pinus contorta). There is shrubby understory of

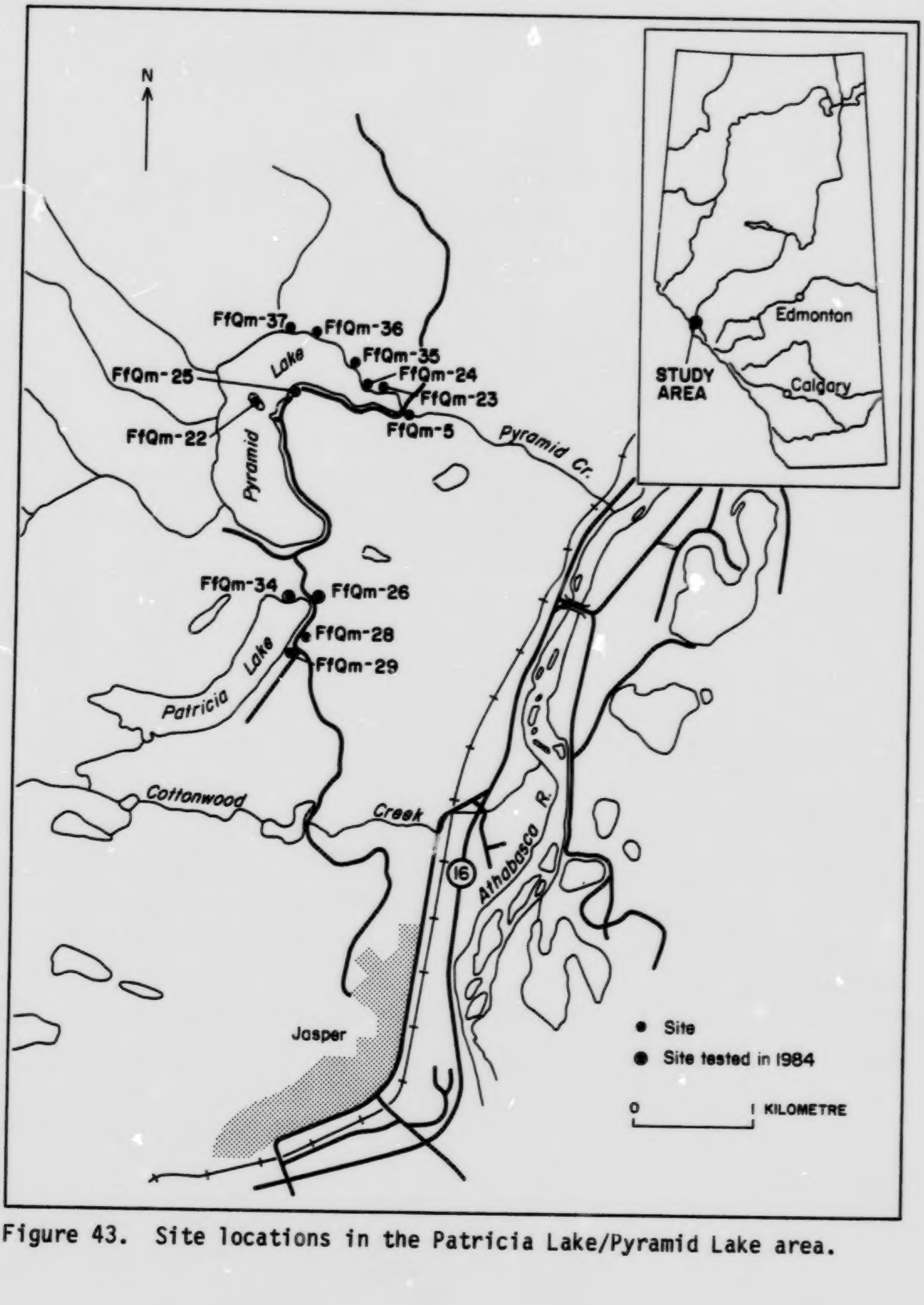
N
FfQm-37
FfQm-36
FfQm-35
FfQm-24
FfQm-23
FfQm-25
FfQm-22
FfQm-5
Lake
Pyramid
Pyramid Cr.
FfQm-34
FfQm-26
FfQm-28
FfQm-29
Patricia Lake
Cottonwood Creek
Athabasca R.
16
Jasper
Edmonton
STUDY AREA
Calgary
● Site
● Site tested in 1984
0 1 KILOMETRE

Figure 43. Site locations in the Patricia Lake/Pyramid Lake area.

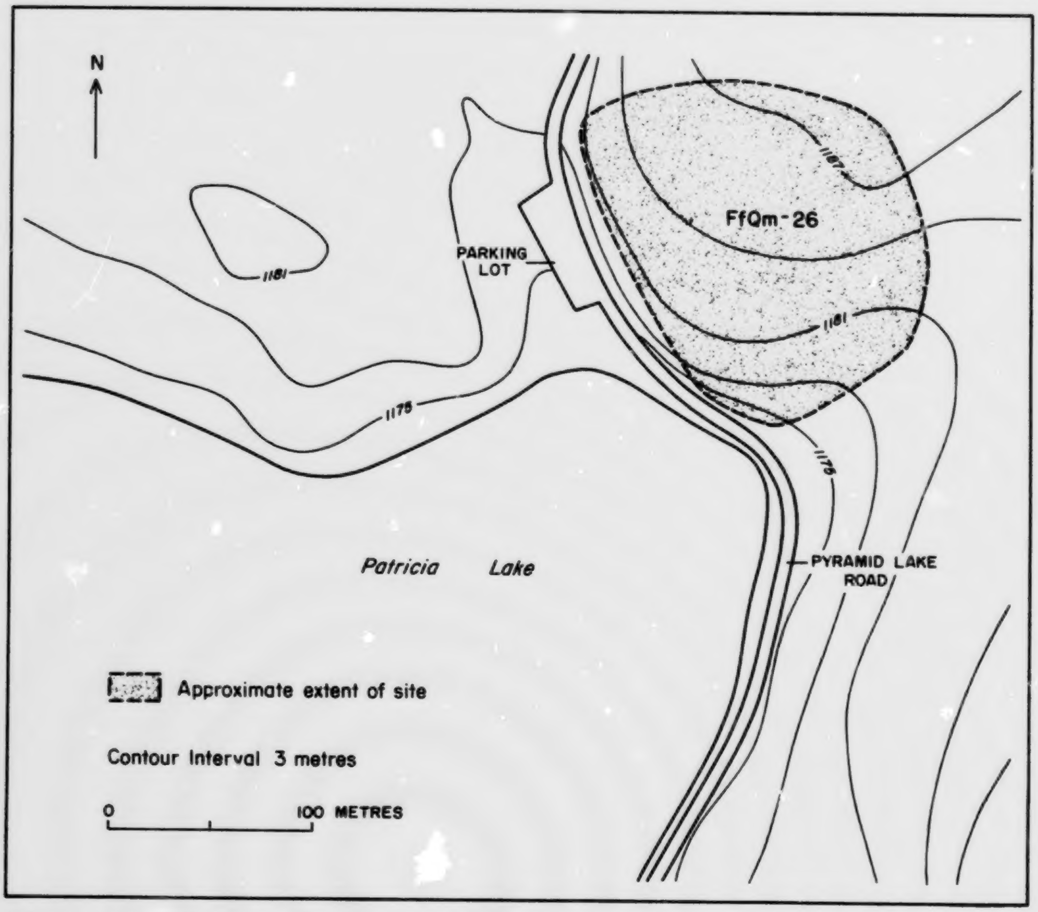
N
FfQm-26
1187
1181
PARKING LOT
1181
1175
1175
Patricia Lake
PYRAMID LAKE ROAD
▨ Approximate extent of site
Contour Interval 3 metres
0
100 METRES

Figure 44. Known extent of FfQm-26.

buffalo-berry and prickly rose. The site is located in a grassy open area on a south-facing aspect overlooking the lake.

PREVIOUS STUDIES

Two prehistoric sites were recorded on the Pyramid Bench during a 1970 and 1971 inventory project (Elliott 1970-71). One is located near the outlet of Pyramid Lake (FfQm-5) and the second is near Cottonwood Slough (FfQm-6). A corner-notched projectile point and a projectile point tip were collected from surface context at the latter site (Anderson and Reeves 1975). Head (1983) and Pickard (1984) recorded a total of ten new sites in the area in 1983 (Figure 43). The 1983 investigations demonstrated that these prehistoric sites generally consisted of shallowly buried lithic artifacts situated on well-drained level to undulating landforms near existing lake margins. The Patricia Lake site fits this pattern.

THE PATRICIA LAKE SITE

Archaeological investigations at the Patricia Lake site encompass three separate projects: the original discovery and testing of the site in 1983 (Operation 2), the 1984 test programme (Operation 3), and the 1984 block excavation (Operation 1) (Figure 45). The following report will primarily focus on 1984 activities (see Head 1983 for further details on 1983 work). Information is presented on approaches to site testing, stratigraphic interpretations and the results of lithic analysis.

METHODOLOGY

The 1984 research design for Patricia Lake site consisted of an extensive systematic shovel testing programme. The site was gridded into a series of east-west and north-south baselines, and tests were excavated at the juncture of each 10 m block. Tests were 50x50 cm, excavated to depths ranging from 15 to 36 cm into sterile glacial till. A total of 170 tests were completed over a 17,000 square metre area, a total sample fraction of less than one half of one percent. Apart from one line of test pits which were trowelled and visually sorted, all sediments were screened through 6 mm mesh. Each productive test was assigned a different lot number in the Parks Canada excavation system. A total of 73 (43%) productive tests were recorded during this phase. Vertical provenience of the artifacts was not recorded because cultural deposits appeared to be reworked or disturbed through bioturbation. The purposes of this approach were to (1) determine the areal extent of the site, (2) delineate areas of lithic concentrations, (3) determine the most and least favourable road alignments, (4) understand stratigraphy across a large area, and (5) design optimal information recovery for future controlled excavations.

Since one of the main objectives of the 1984 assessment was to obtain temporal control through the collection of radiometric and typological

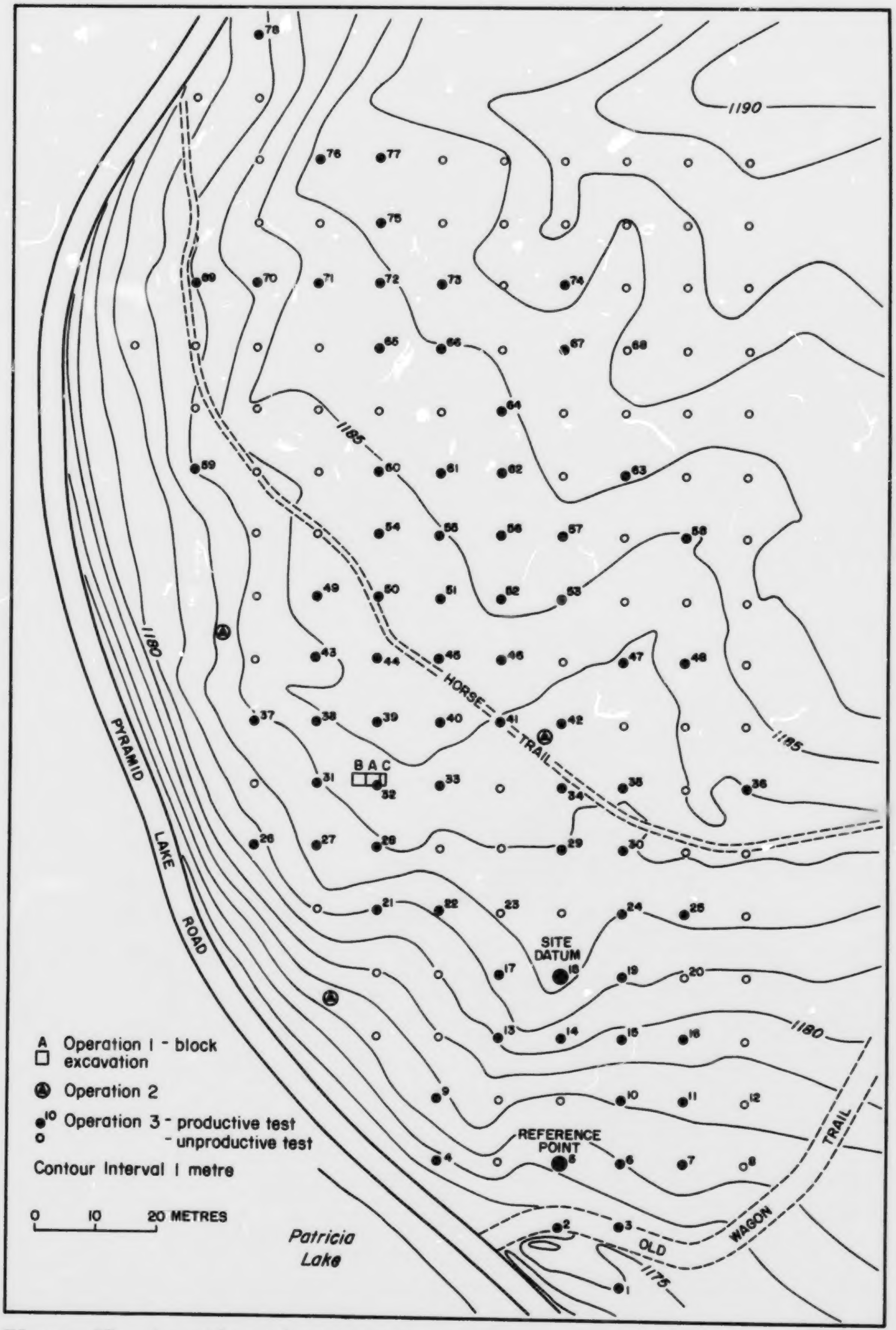
1190
1185
1180
1175
HORSE TRAIL
PYRAMID LAKE ROAD
OLD WAGON TRAIL
SITE DATUM
REFERENCE POINT
B A C
Patricia Lake
A Operation 1 - block excavation
Operation 2
Operation 3 - productive test
- unproductive test
Contour Interval 1 metre
0 10 20 METRES

Figure 45. Location of excavation units at the Patricia Lake site.

information, a small block was excavated. The block excavation covered a ten square metre area and was comprised of three excavation units. All sediments were trowelled and screened through 3 mm mesh. Vertical control conformed to a combination of natural and arbitrary units. The block excavation was designated Operation 1 under the Parks Canada excavation system. Each separate excavation unit was assigned a sub-operation letter (A, B and C). Arbitrary and natural vertical levels were assigned sequential lot numbers from 1 at the surface to 3 at glacial tills. Subsequent analytical steps were formal tool and debitage descriptions and soil analysis.

The systematic testing revealed that, although vertical stratigraphic separation was not apparent, there appeared to be evidence for horizontal separation. Thus, horizontal stratigraphy seemed to offer the best method for separating different activity areas and/or temporally discrete site manifestations. All lithic artifacts from the Patricia Lake site were analyzed and catalogued on computer coding sheets. These data were key punched and tabulated through use of the SPSS package "Crosstabs." Tabulations were then used in the Surface II computer mapping package to identify horizontal stratigraphic units.

VERTICAL STRATIGRAPHY

Soils at the Patricia Lake site exhibit a thin, dark yellow-brown litter mat 1A horizon. A well-developed iron, aluminum and humus enriched Bm horizon, characteristic of a brunisolic luvisol, is evident below the upper horizon. The Bm horizon, which corresponds to the most culturally productive layer, rests on a yellow-brown C horizon composed of fluvial and aeolian deposits. The C horizon was laid down on top of a glacial moraine subsurface, the upper portions of which showed evidence of fluvial reworking (see Figure 46).

A soil column was taken from the Patricia Lake site. The first sample was taken from the surface to 3 cm below surface. This layer corresponded to the sod and litter mat level with a Munsell colour of 10YR4/4. The second sample was collected from the Bm horizon, from 3 to 13 cm below surface. The third sample was collected from the reworked aeolian deposit overtop the glacial till layer, from 13 to 19 cm

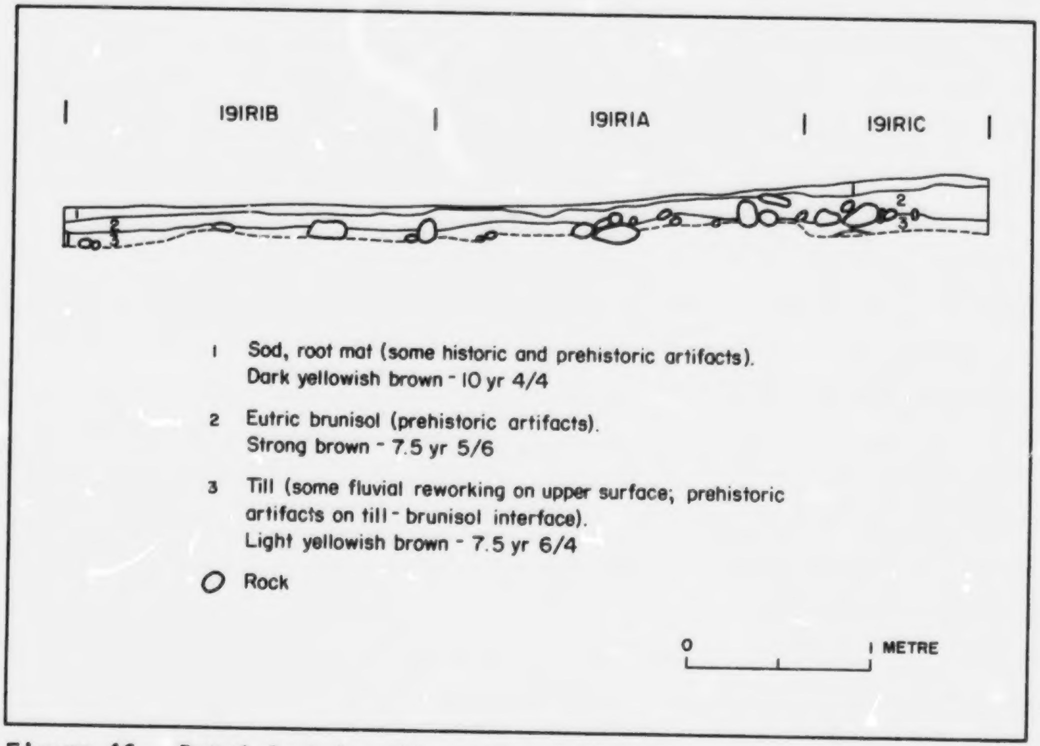
19IR1B
19IR1A
19IR1C
1
2
3
1 Sod, root mat (some historic and prehistoric artifacts). Dark yellowish brown - 10 yr 4/4
2 Eutric brunisol (prehistoric artifacts). Strong brown - 7.5 yr 5/6
3 Till (some fluvial reworking on upper surface; prehistoric artifacts on till - brunisol interface). Light yellowish brown - 7.5 yr 6/4
O Rock
0
1 METRE

Figure 46. Patricia Lake site soil profile.

below surface. Volcanic ash particles were identified within the first and second sample units and have been tentatively identified as St. Helen Yn Set from Mount St. Helens in southern Washington (King personal communication 1984). The date for this ashfall is 3,400 years B.P. (Mullineaux et al. 1975:333). It seems likely that the ash was deposited near the upper portion of the profile and was subsequently mixed (by various forms of natural disturbance) throughout Lot 1 and Lot 2. Its absence in Lot 3 suggests that this horizon predates 3,400 years B.P.

The thickness of soil horizons varied across the site with the upper horizon ranging from 2 to 8 cm, depending on vegetation and slope. Glacial till was encountered at depths ranging from 3 cm, where soil development was minimal, to depths of 26 cm, where the surface sod was well developed. The boundary between the upper organic horizon and the Bm horizon was distinct, while the boundary between the bottom of the Bm and the till horizon was indistinct.

Charcoal was present at the boundary of the upper organic layer and the Bm horizon, likely marking relatively recent forest fires which swept the Patricia Lake area (see Tande 1977 for an excellent fire history of the Jasper townsite and surrounding area). For the most part, very little charcoal was noted in lower horizons.

In summary, the Patricia Lake site lacks clearly separable stratigraphic units because the profile has been altered by both natural and cultural processes. The natural stratigraphic record at the site reflects glacial till deposition followed by aeolian deposition and soil formation. It would appear that the post-glacial period has been relatively stable with only minor fluctuations.

HORIZONTAL STRATIGRAPHY AND SURFACE II MAPPING

Archaeological investigations at the Patricia Lake site in 1983 indicated that the site contained significant amounts of lithic remains, including diagnostic projectile points. Test excavations also demonstrated that natural stratigraphy was weakly developed and that vertical cultural stratigraphy was not readily observable. Interpretation of non-stratified archaeological sites is a major problem faced by archaeologists in many culture areas. The 1984 testing programme was specifically designed to address this problem.

The 1983 test programme suggested that artifacts were dispersed over a relatively large area. With this in mind, the site was systematically tested in 1984 to identify possible horizontal stratigraphy. Horizontal stratigraphy offers the greatest potential for interpreting activity areas and/or distinct cultural components in non-stratified sites; however, such potential may be limited, depending on the nature of the particular archaeological site. Factors which could affect horizontal separation include: the sheer density and complexity of the archaeological remains, vertical mixing due to compressed stratigraphy, other natural processes such as solifluction and root disturbance, and cultural processes such as disposal patterns.

The approach selected to attempt to identify horizontal stratigraphy involved gridding the site into a total of eleven north/south gridlines and twenty east/west gridlines marked at 10 m intervals. Shovel tests were excavated at each juncture. The north and south terminal points were defined by topography of the landform and 1983 test results. The eastern edge of the grid was established by an apparent decrease in density of cultural material. The western edge of the site was defined by steep natural slope to the shore of Patricia Lake and the location of the road. Units were numbered both east and west and north and south of a site datum designated 0N, 0E (Figures 45 and 47).

Following the field season, lithic data were analyzed and catalogued on computer coding sheets. Lithic raw material type was selected as a possible means of identifying horizontal stratigraphy. The relative quantity, nature and distribution of lithic raw materials is an important archaeological interpretive tool. Some factors which influence the selection of lithic raw materials are availability, suitability and cultural preference. Exploitation patterns and utilization of lithic raw materials are also known to vary through time and space.

Lithic material types were lumped into five major categories (quartzite, chert, siltstone, basalt and other) and tabulated using the SPSS Program Crosstabs. Surface II, a computer software system which creates displays of spatially distributed data, was used to create "contour" maps of lithic artifact density across the sites. The Surface II mapping package created a grid using local fit methods and interpolated contours through a nearest neighbour search. Figure 48 is the overall density map showing the distribution of artifacts found during site testing and is limited to 819 artifacts found within Operation 3. The programmed contour interval on the map was one artifact; however, many lines had to be suppressed for clarity and thus each line has been labelled. Three major clusters, defined as Clusters A, B and C from north to south, were identified (Figure 54). The clusters can be interpreted as being distinct activity areas, temporally different occupations or, alternatively, as a function of sampling. The lithic raw material composition of the highs and lows was examined to determine whether they could be interpreted as activity areas or as temporally distinct occupations. Lithic raw material types were used because they are easy to distinguish, because use of different sources appears to vary through time, and because different types may reflect different activities across the site.

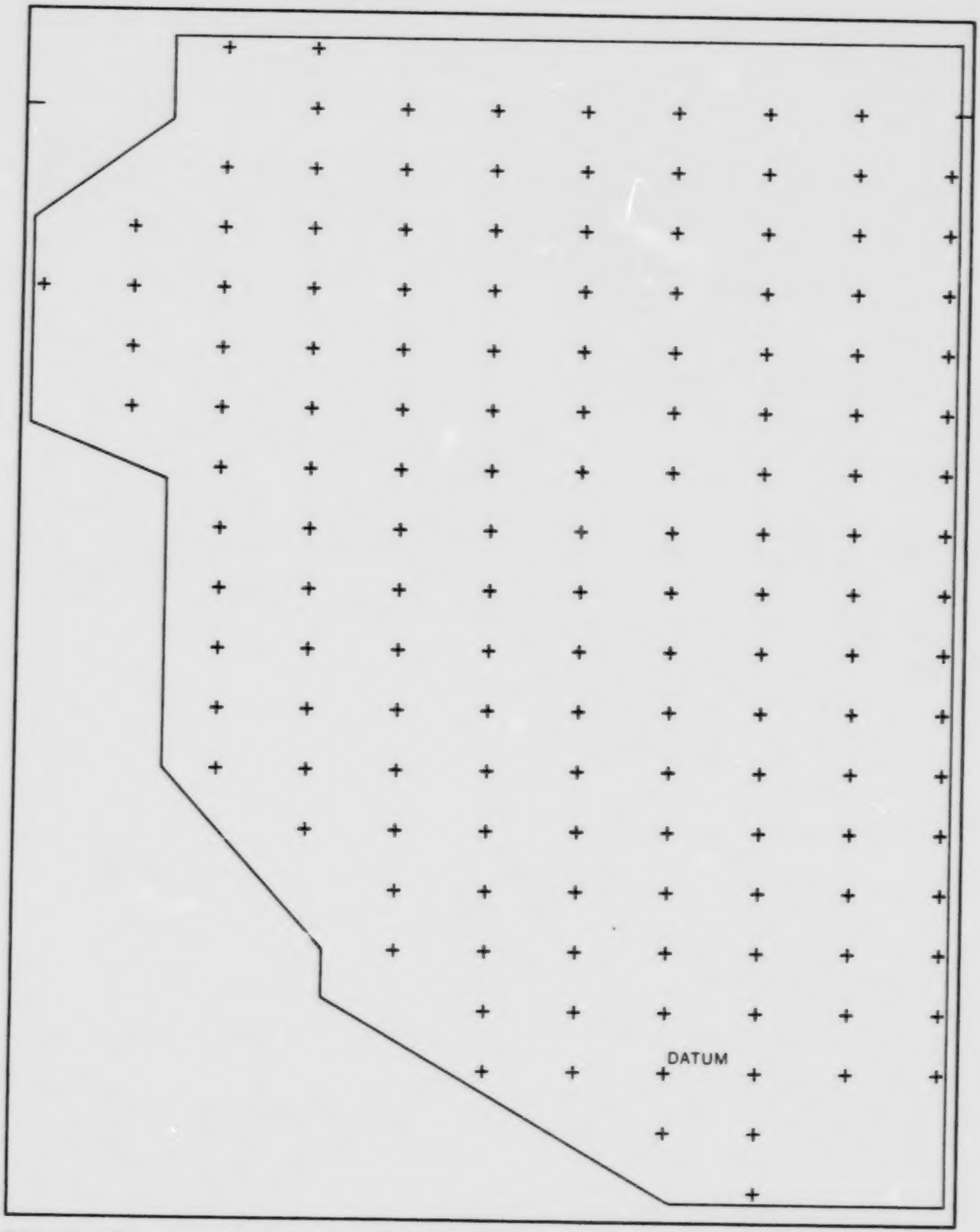

Figure 47. Shovel test locations at the Patricia Lake site.

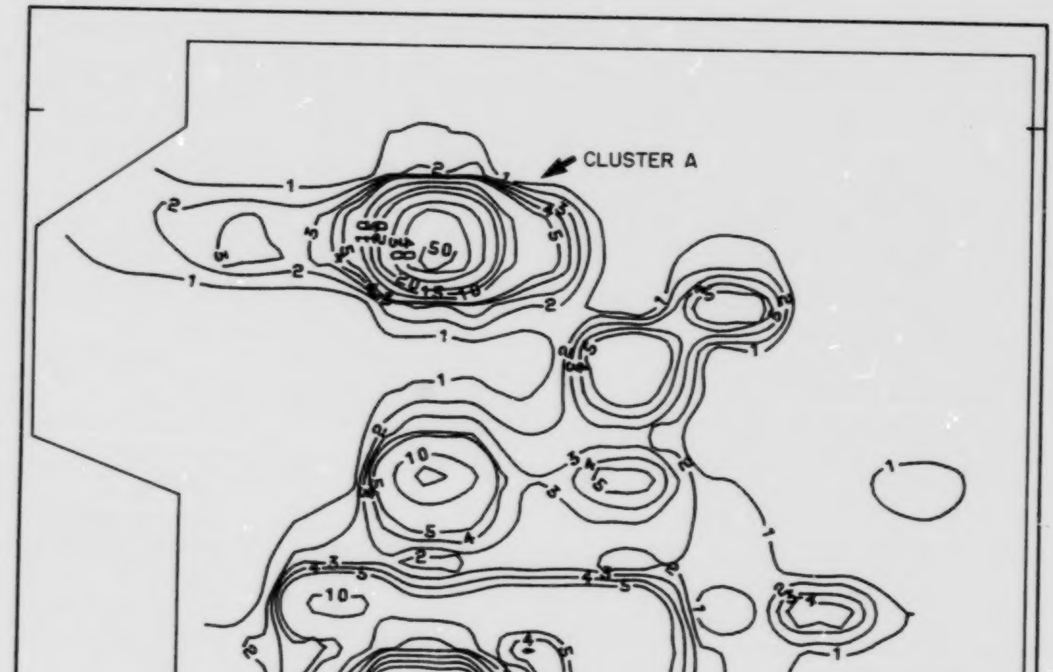
CLUSTER A
CLUSTER B
CLUSTER C

Figure 48. Lithic raw material distribution at the Patricia Lake site.

Maps showing the distribution of quartzite, chert, siltstone and basalt were prepared (Figures 49-52) and reveal distinct patterns of lithic raw material type use across the site. The type composition of each cluster is shown on Table 6. Cluster A is distinguished by a high proportion of quartzite, moderate amounts of siltstone and chert, and no basalt. Cluster B has a slightly lower percentage of quartzite and moderate amounts of siltstone, chert and basalt. Cluster C has a very low percentage of quartzite, significantly more siltstone, chert and basalt, and a higher percentage of "others" (including chalcedonies unique to Cluster C, vein quartz and quartz crystal).

Quantitative methods were used to clarify and define the clusters and to test both the data and the reliability of the maps as interpretive tools. Kendall's Coefficient of Concordance, a non-parametric statistic which uses ranked data, was selected as a suitable test. A coefficient score can range between 1.0 and 0. A score of 0 would mean that there is absolute disagreement between the composition of the clusters whereas a score of 1.0 would mean that all three clusters show perfect agreement in the composition (relative frequencies) of the ranked raw materials.

The calculated value of the coefficient was .37, suggesting that there was disagreement between the composition of the clusters. The reliability of the coefficient was tested using a one sample goodness-of-fit test: Chi-square. The results denied rejection of the null hypothesis at the .05 significance level, meaning that there is no statistically significant agreement between the three clusters as to the ranked importance of the four major lithic raw material types. This tends to support the interpretation that the clusters illustrated by the maps do, in fact, represent significantly different discrete compositions of lithic material types, probably due to differences in site use activity patterns over space and/or time.

LITHICS

Lithic artifacts were classified into categories consistent with those generally applied throughout Alberta. Tools represent those artifacts modified for use, or exhibiting indications of use, and include cores and core fragments. Debitage comprises the by-products of various

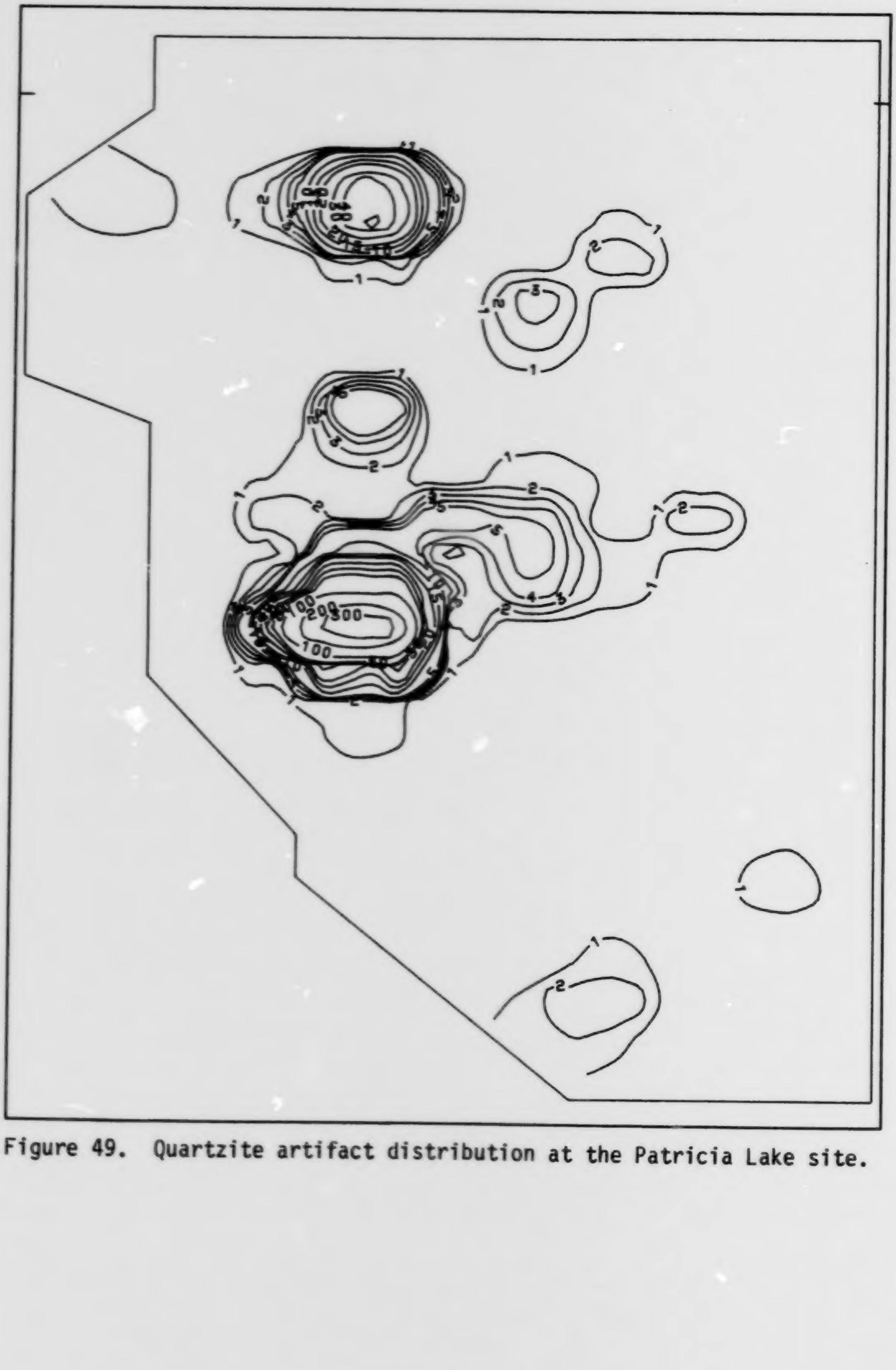
1
2
1
2
3
1
2
5
2
1
2
1
2
3
5
2
1
2
5
4
3
2
1
100
200
300
100
1
1
2
1
2

Figure 49. Quartzite artifact distribution at the Patricia Lake site.

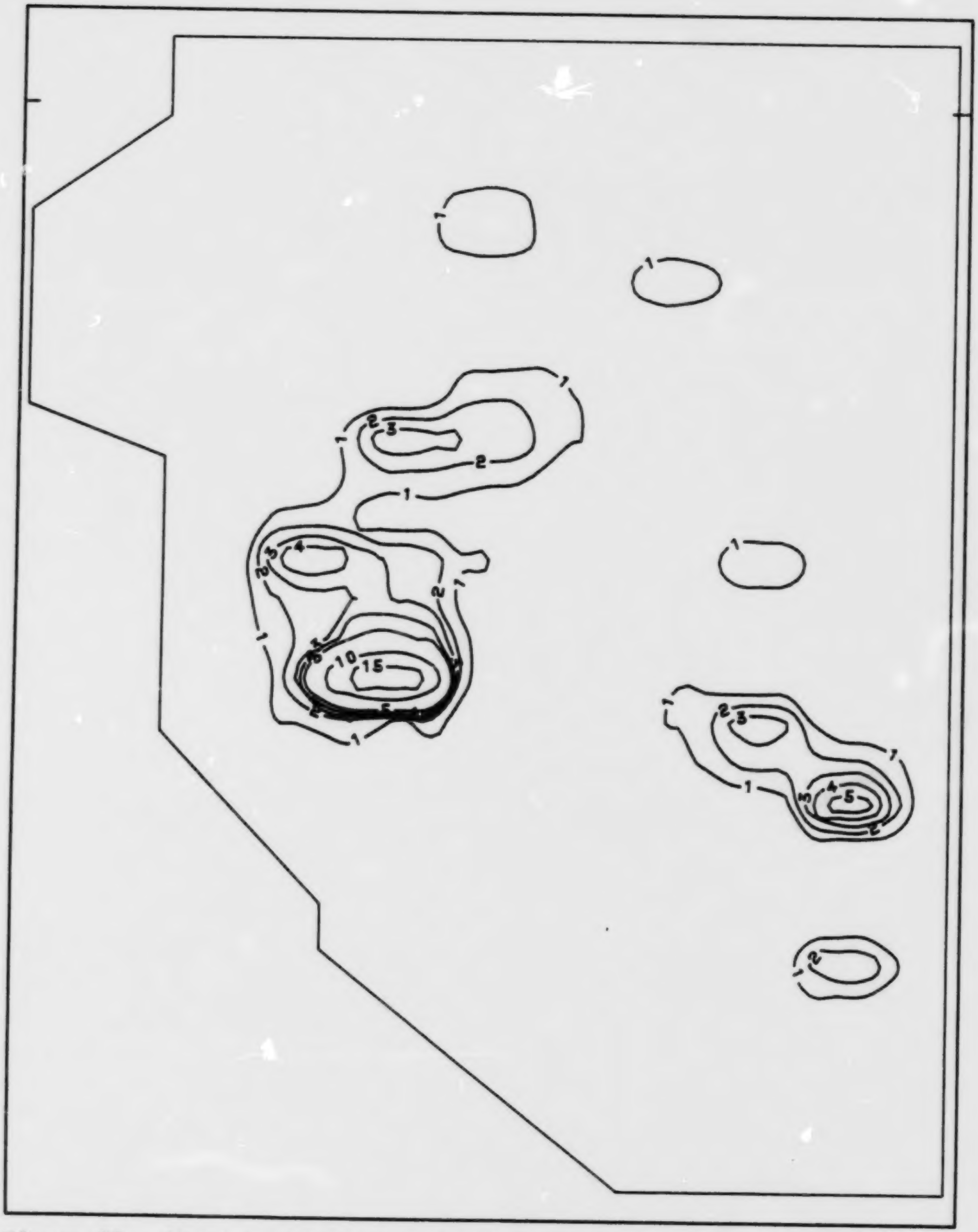
1
1
1
2
3
2
1
1
3
4
2
2
1
1
1
10
15
5
2
1
1
2
3
1
1
3
4
5
2
1
2

Figure 50. Chert artifact distribution at the Patricia Lake site.

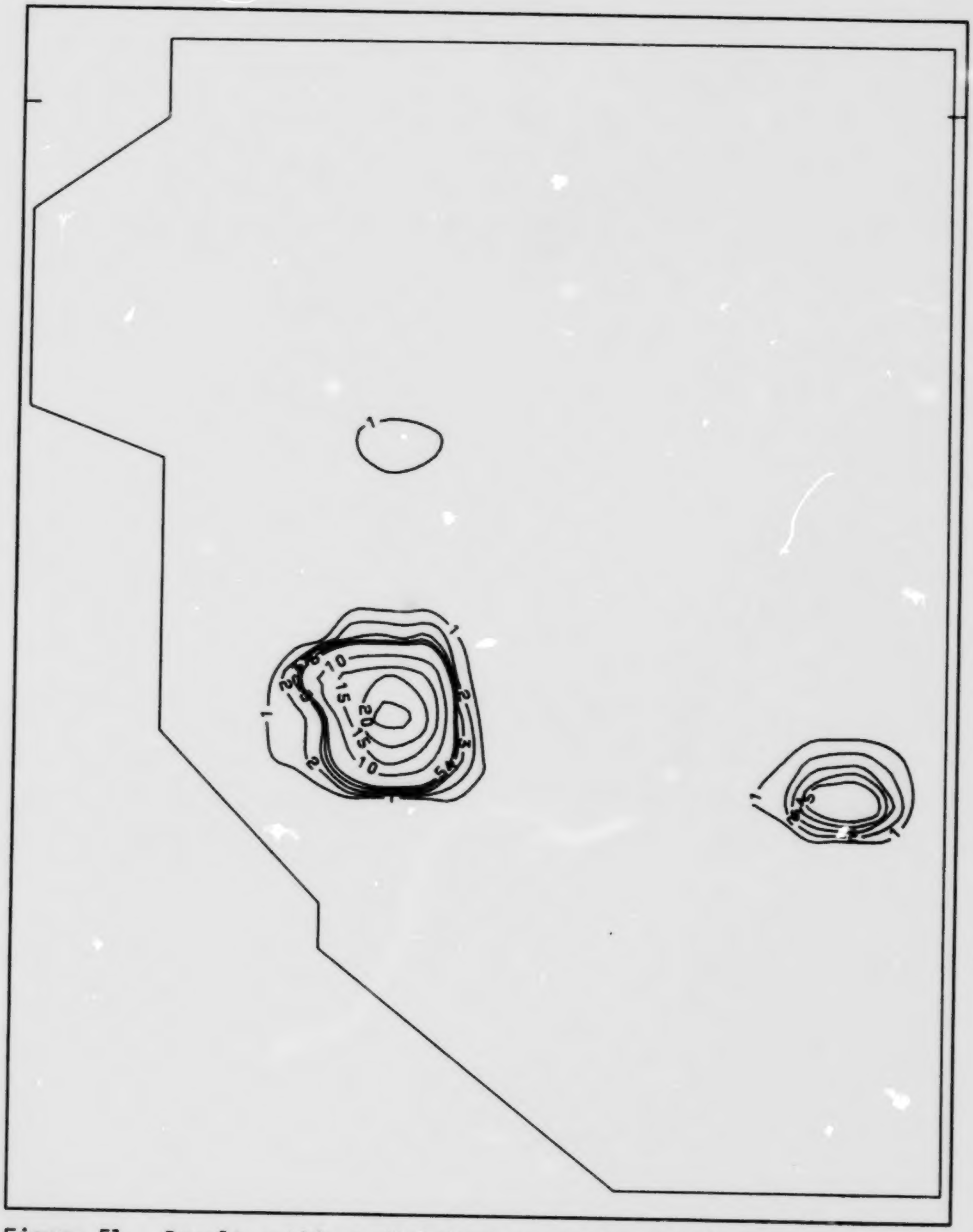
1
1
10
15
20
20
15
10
2
2
1
2
3
5
1
1
5

Figure 51. Basalt artifact distribution at the Patricia Lake site.

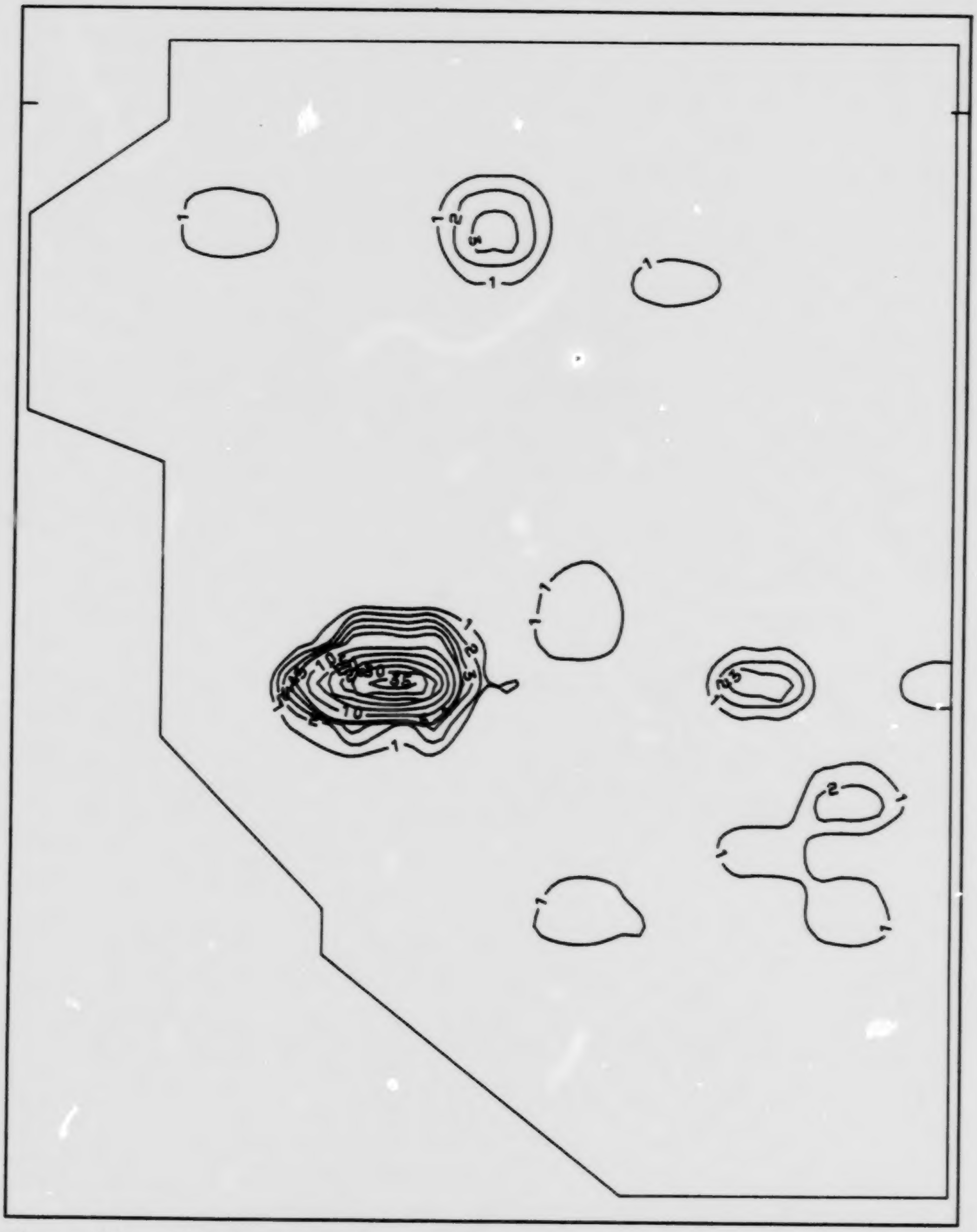
1
1
2
3
1
1
1
2
3
10
30
1
2
3
10
1
2
3
1
2
1
1
1
1

Figure 52. Siltstone artifact distribution at the Patricia Lake site.

Table 6. Lithic material type percentage by cluster, Operation 3, Patricia Lake site.

Cluster	Quartzite	Siltstone	Chert	Basalt	Others	
A (n=81)	81.8	10.2	3.4	-	4.6	(QT13/obsidian/ qtz crystal)
B (n=663)	71.4	8.2	7.7	8.4	4.3	(QT13, 15/CH32, 33/qtz crystal/ CL03/ironstone/ petrified wood)
C (n=67)	15.0	26.8	25.5	13.4	19.3	(CL04, 05, 06/ petrified wood/qtz crystal/vein quartz)

activities involving lithic reduction, tool production and tool maintenance. Analytic categories used employ a combination of morphological and presumed functioned parameters, as is the general case in most other studies in the region.

TOOLS

Of the 6,074 lithic artifacts recovered from the Patricia Lake site, 63 were classified as tools. This total represents only 1.03 percent of the total assemblage and suggests that either high levels of tool curation and reuse took place or resource processing constituted considerably less of the on-site activities than did lithic reduction/tool production.

The variation in types represented indicates that a variety of campsite related activities occurred. A number of typical tool types were recognized in the collection, including projectile points, bifaces, scrapers, flake tools (especially gravers), hammerstones and an anvil (Table 7). Several core types were also recognized, including one believed to be a microblade core. For the purposes of this paper, these are only briefly summarized; more complete information will be provided in a forthcoming final report. Because projectile points are generally recognized as chronologically and culturally sensitive forms, more detailed discussion is presented below.

PROJECTILE POINTS

A total of fifteen projectile points and projectile point fragments, representing a variety of morphologically determined groupings, were collected from the site. The age and cultural association of these types has not been determined.

Small Stemmed Projectile Point Fragments (n=3)

Form: All three samples are transversely snapped proximal portions. Bases are slightly convex to rounded. Stems are expanded on two samples; the shape of the stem on the third specimen is difficult to determine.

Modifications: All three specimens exhibit irregular bifacial flaking. Burination can be observed along both lateral edges from the medial break of one point (Figure 53c). The burinated point also displays grinding of the base and margins of the stem. Another point has minor basal grinding.

Lithic Type: Flat black chert, vitreous grey chert and grey quartzite. The burinated projectile point portion is manufactured from vitreous grey chert. The same material has been used to manufacture microblades in this general area, as evidenced by the discovery of microblades at site FiQk-4 on nearby Brule Lake.

Large Stemmed Points (n=2)

Form: Both examples are symmetrical, complex forms with straight bases. One specimen has a contracting stem, obtuse shoulders and excurvate body edges (Figure 54a). The second item has an expanding stem, angular shoulders and triangular body edges (Figure 54b).

Modification: The base of one form has been thinned on the ventral surface. The stems on both specimens have been ground.

Lithic Type: Dark grey quartzite

Table 7. Artifact type summary, Patricia Lake site.

Artifact Type	Operation 1	Operation 2	Operation 3
Projectile Points - Stemmed	5		1
Corner-notched	1		
Side-notched	2	1	
Indeterminate	5		1
Bifaces - Complete	1	1	1
Fragment	5	2	7
Scrapers - End	4		1
Side			2
Side and End		1	1
Graver			3
Graver/Scraper	4		1
Graver/Perforator	1		
Hammerstone	2		
Anvil	1		
Cores - Microblade			1
Pebble Core	2		
Utilized Core	1		
Fragment	1		4
Flakes - Utilized	19		
Retouched	4		
Decortication	62		18
Secondary	333	7	89
Thinning/Bifacial Thinning	1186	22	170
Split Pebble	4	1	7
Core Rejuvenation	71	4	22
Retouch	683	23	55
Macroblade	2		
Shatter	2736	58	435
Total	5135	120	819

Large Stemmed Point Fragment (n=1)

Form: This fragment is the proximal portion of an ovate stemmed point (Figure 54c). The stem contracts to the base. Potlids on either side of the base of the stem obscure any evidence of basal grinding.

Modifications: The specimen has been heavily heat treated, leaving a number of potlids.

Lithic Type: Black Siltstone

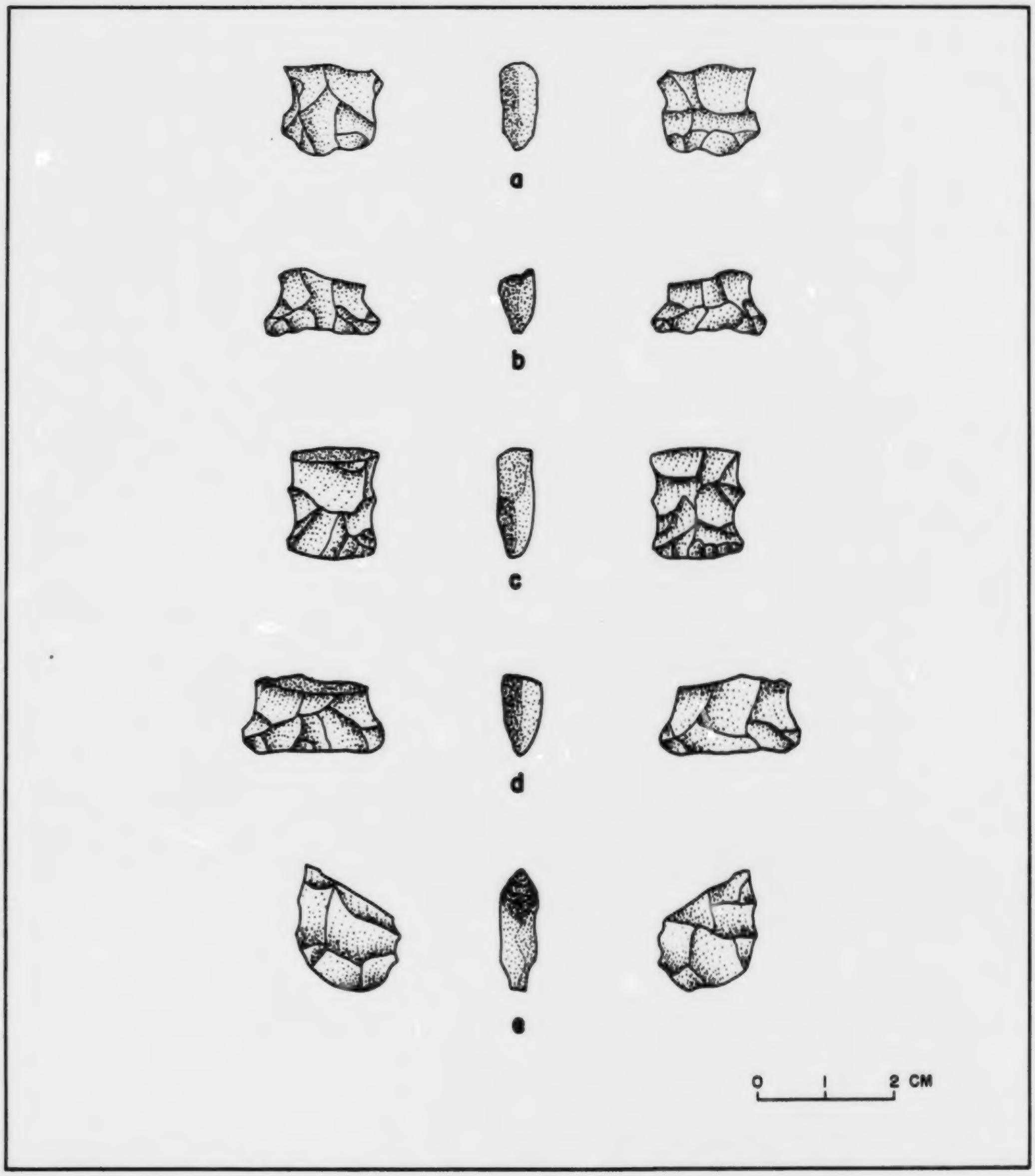
a
b
c
d
e
0
1
2 CM

Figure 53. Projectile point fragments, Patricia Lake site.

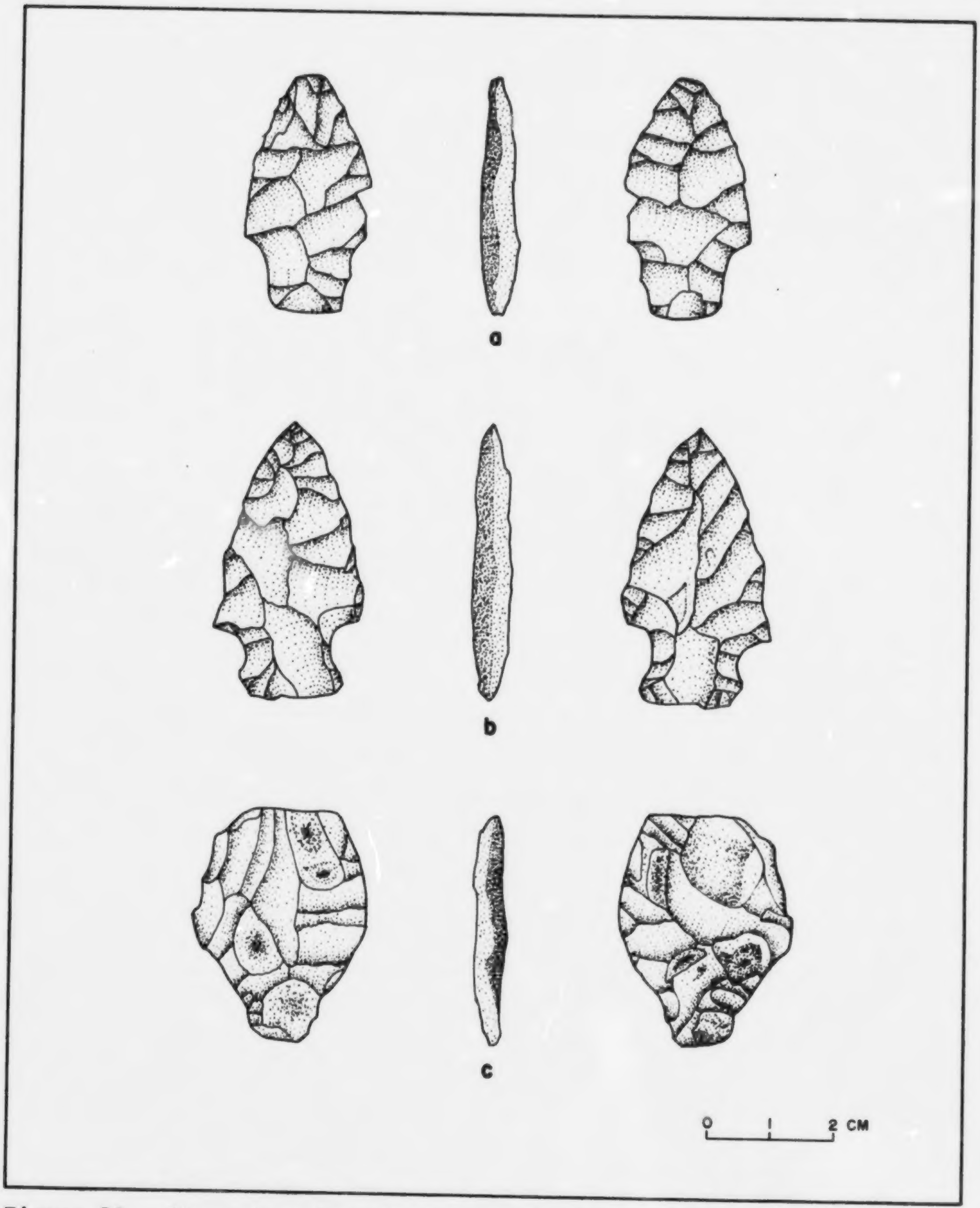

Figure 54. Stemmed projectile points, Patricia Lake site.

Side-notched Projectile Point (n=1)

Form: The point is a complete contracting triangular form with an excurvate right lateral edge and a straight left lateral edge (Figure 55d). The base is straight and the shoulders are obtuse. Both notches are round and shallow, and the right notch is deeper than the left. This specimen is biconvex in transverse and longitudinal cross sections.

Modifications: The point is pressure flaked in a chevron pattern, and the base is bifacially thinned and ground.

Lithic Type: Basalt (tentative identification)

Small Side- and Corner-notched Projectile Points (n=3)

Form: The first specimen is a proximal portion of a shallowly side-notched flake point with a slightly convex base (Figure 55b). It is plano-convex in both longitudinal and transverse cross sections. The second specimen is a contracting triangular flake point with a snapped tip and has been classified as a corner-notched type based on the orientation of the notch (Figure 55c). The left lateral edge is excurvate and the right lateral edge is indeterminate. It is biconvex in longitudinal cross section and plano-convex in transverse cross section. Notches are rounded and shallow and the base is straight. The third specimen is a contracting triangular side-notched form with excurvate lateral edges and a straight base (Figure 55a). The left basal corner is missing. It is biconvex in longitudinal and transverse cross sections.

Modification: The two flake points have been randomly flaked on the dorsal surface with minor pressure retouch on the ventral surface. All three examples have been ground along the base.

Lithic Type: Lustrous grey chert (2) and dark grey quartzite (1)

Projectile Point Fragments (n=6)

Form: Two fragments are transversely snapped base portions. One proximal base portion appears to be a side-notched form (Figure 53b). The third specimen is a tip. The fourth and fifth fragments are unidentified portions. The sixth specimen is a body fragment of a potentially early style projectile point based on the projected body size (Figure 56c).

Modification: The margin of one base has been extensively ground.

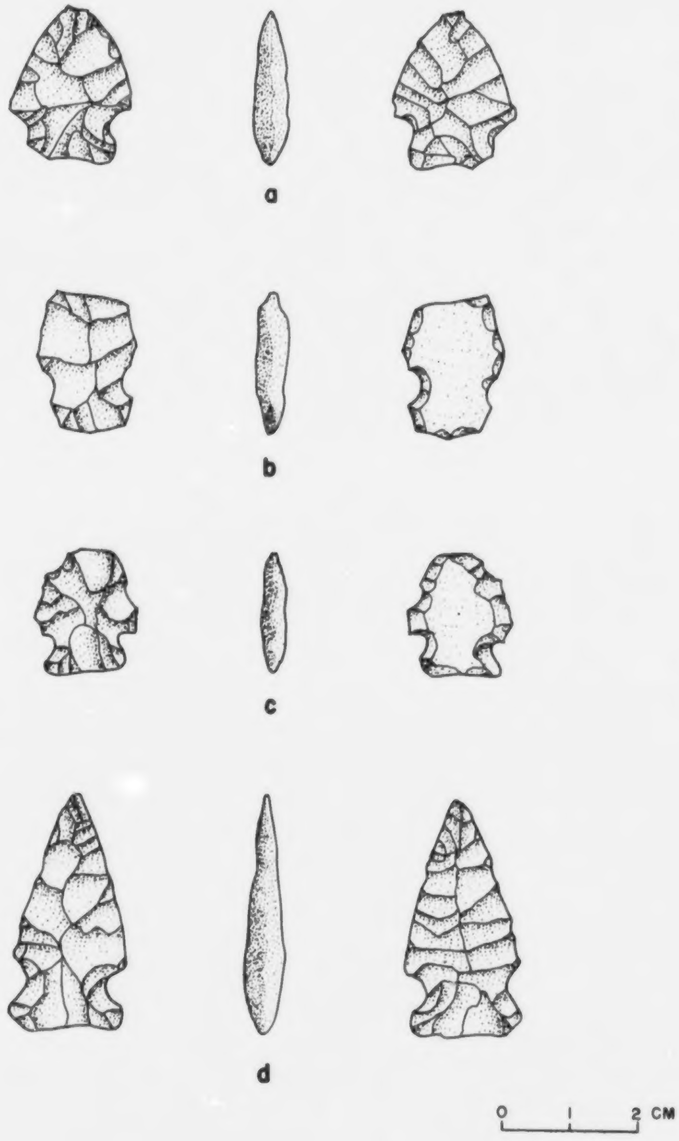

Figure 55. Projectile points, Patricia Lake site.

Lithic Types: Siltstone, vitreous dark grey chert, white quartzite and basalt

OTHER TOOLS

Bifaces

Three complete and thirteen fragmentary bifaces occur in the collection. Complete specimens include bipointed, symmetric ovate (Figure 56d) and discoidal forms. Modification is variable as are cross section morphologies.

Scrapers

Three complete and three endscraper fragments were identified. Forms represented are discoidal/split pebble, triangular expanding and square. Modification and cross section morphology vary considerably in these types. Two irregularly shaped, broken and heat treated endscrapers are present in this collection as is one ovate side and end scraper.

Flaked Tools

Five items classified as graver scrapers occur in the sample. These are multiple-edged tools exhibiting a steeply angled linear scraping edge and a projection suitable for engraving purposes. The original flake shapes vary, including irregular, tabular and quadrilateral and expanding triangular forms. Working edges were created primarily by marginal retouch which varies in extend and location. An irregularly shaped graver perforator and three gravers manufactured on specialized flake types (two bifacial thinning and one core rejuvenation) were also identified in the collection.

Unmodified Stone Tools

Two quartzite hammerstones and one quartzite anvil were recognized in the sample. Their presence suggests both the use of hard hammer percussion and bipolar cobble and pebble reduction techniques.

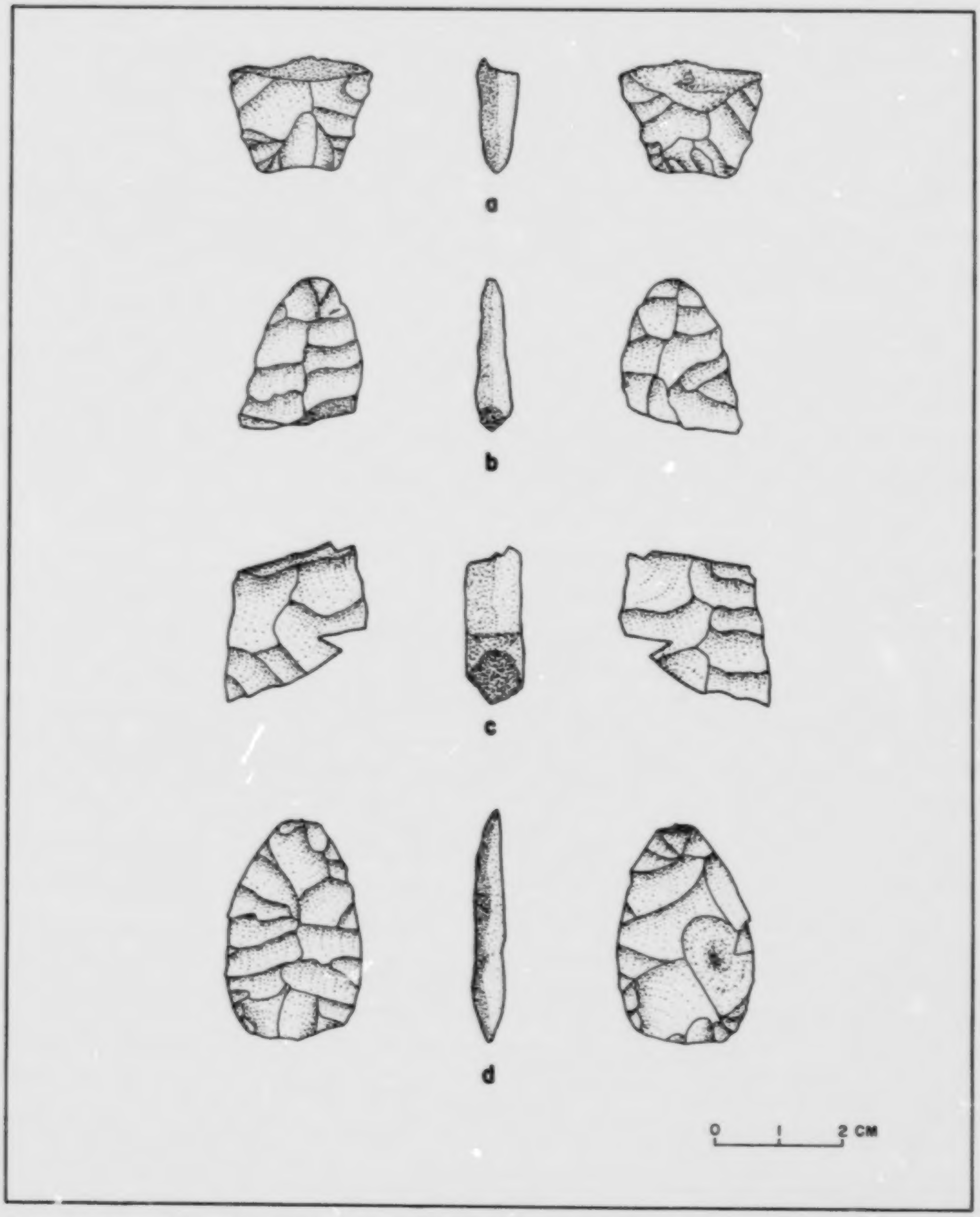

Figure 56. Miscellaneous formed tools: (a) lanceolate projectile point, (b) biface, (c) projectile point body fragment and (d) biface.

Cores

Two pebble cores of indeterminate form occur in the collection as does one utilized fire-treated siltstone core exhibiting a random flaking pattern. A single complete exhausted microblade core (Figure 57b) is notably present in the sample. It is quadrilateral in form and the cross sections are asymmetrical convex. The lithic material used for this specimen is vitreous grey chert.

DEBITAGE

Debitage has been defined to include primary decortication flakes, secondary decortication flakes, secondary flakes, thinning flakes, bifacial thinning flakes, core rejuvenation flakes, retouch flakes, and shatter (see Table 7).

Primary decortication flakes form less than one half of one percent of the total debitage (n=24, 17 from Operation 1). Secondary decortication flakes form 1.0 percent of the total debitage (n=62, 45 from Operation 1). The low frequencies of these two categories indicate that very little initial core preparation and/or shaping occurred at the site.

Secondary flakes form 7.1 percent of total debitage (n=428, 339 from Operation 1). This low percentage suggests that most of the secondary blank production was carried out off-site or in an unexcavated area of the site, an interpretation which is also suggested by the low incidence of cores. Many of the secondary flakes may have been fortuitous by-products of the production of other tools (especially bifaces) on-site rather than as a result of deliberate blank production.

Thinning flakes form 12.6 percent of the total debitage (n=758, 626 from Operation 1). No apparent clustering of thinning flakes could be determined. The proportional frequency of this type suggests that the latter stages of lithic reduction from flake blanks into various tool forms, including bifaces, represents an important activity.

Split pebbles form less than 1.0 percent of total debitage (n=12, 7 from Operation 3). One of the specimens deserves elaboration. It is irregular in shape, biplano and tabular in longitudinal and transverse cross sections, respectively. Two flake scars are present along the

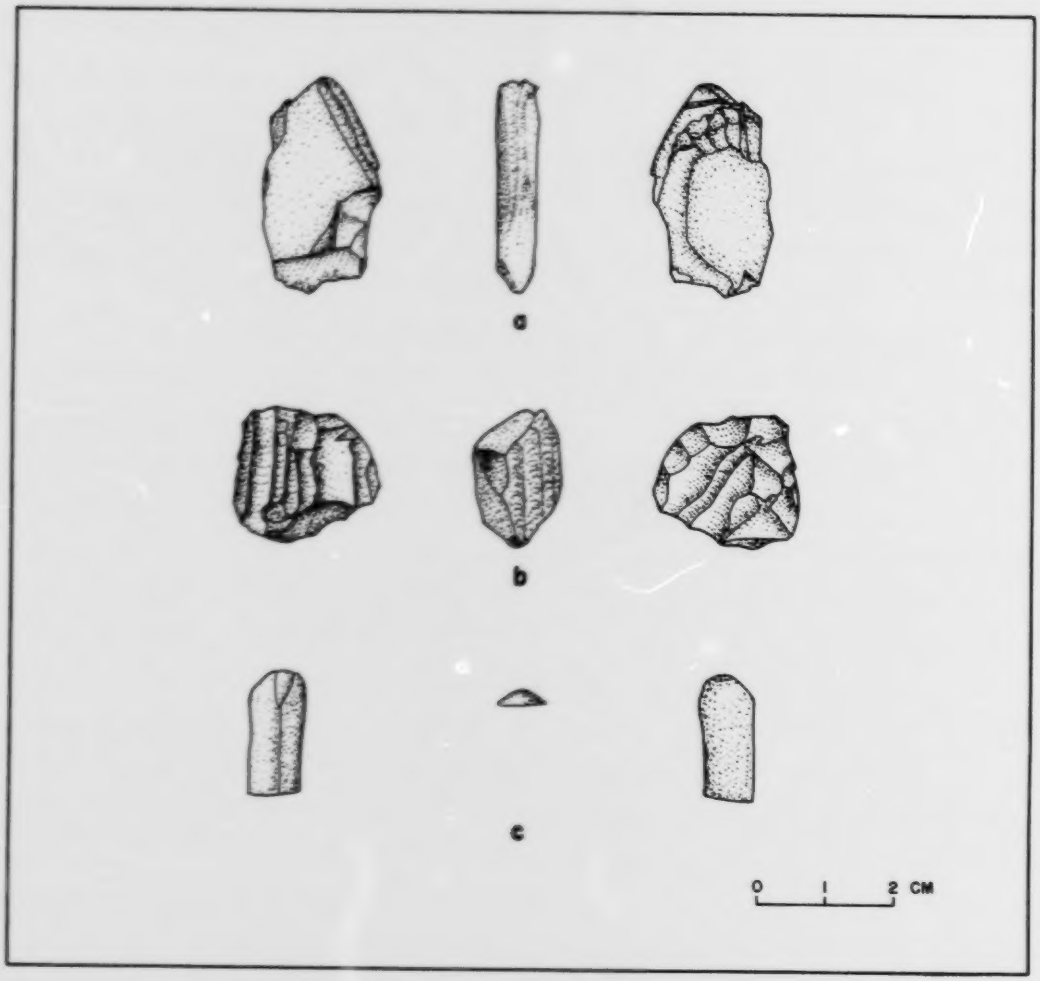

Figure 57. Miscellaneous cores and lithic artifacts: (a) split pebble, (b) microblade and (c) microblade.

margin. This example is of lustrous dark grey chert, the same lithic raw material as the exhausted microblade core. The flake scars are possibly suggestive of microblade production.

Bifacial thinning flakes formed 10.4 percent of total debitage (n=621, 561 from Operation 1). The forty bifacial thinning flakes from Operation 3 appear to be distributed along the upper terrace edge. No occurrences were noted downslope or south of the upper terrace edge. The relatively high percentage of this group suggests that the latter stages of bifacial reduction represent a major site activity. The thinning and bifacial thinning percentages suggest that primary reduction was occurring off-site and lithic raw materials were being brought to the site in a reduced form; thinning and bifacial thinning then occurred on-site.

Core rejuvenation flakes form 1.6 percent of total debitage (n=97, 71 from Operation 1). These appear to be distributed over the site area with no apparent clustering. Not surprisingly, there are corresponding low frequencies of rejuvenation flakes in the assemblage.

Retouch flakes form 12.5 percent of total debitage (n=749, 683 from Operation 1). Retouch flakes were distributed along the upper terrace from the datum to the northern limit of the site. Some clustering occurred in a 20 m radius around the block excavation (Figure 45). The frequency of this type suggests that tool maintenance and resharpening as a major activity on the site.

Shatter forms 53.9 percent of total debitage (n=3233; 2743 from Operation 1). Quartzite accounts for 84 percent of shatter suggesting that it was being reduced through more stages at this locale than were other lithic material types. The difficulties in discerning feature such as bulbs and platforms on quartzite likely resulted in proportionally more being discarded as shatter. The high incidence of quartzite shatter and core rejuvenation flakes supports the contention that locally available materials were not trimmed extensively before being transported on-site. The proportionally low frequencies of quartzite formed and utilized tools and the inherent difficulty in determining use wear suggest that quartzite flakes were being used as expedient and discardable tools, thereby not appearing to be retouched or significantly worn.

LITHIC RAW MATERIALS

Minimal research has been carried out on the variety and availability of lithic raw materials in the Jasper Park area. Research to date indicates that chert- and siltstone-bearing formations in Cairn Pass, siltstone- and mudstone-bearing formations in Glacier Pass, and chert-bearing formations between Talbot Lake and Edna Lake were used prehistorically. The archaeological literature on the park defines lithic raw material types based on texture, colour, presumed geologic properties, lustre and other visual criteria (Anderson and Reeves 1975; Ball 1983; Pickard 1984). Since no standard criteria or terminology exist, it is likely that the same materials have been described by different terms.

The approach in this project has been to subdivide materials by visual criteria including lustre, grain size, presumed geologic properties, presence or absence of inclusions, colour and translucence. Colour was used as the single most important criterion in subdividing quartzites and quartzoses.

Lithic raw materials at the Patricia Lake site are primarily locally available cherts, chalcedonies, mudstones, siltstones and quartzites. Non-local materials account for less than 5 percent of total raw materials and include obsidian (n=2), petrified wood (n=2) and basalt (n=227). Although basalt has been interpreted as a non-local material, it may have been obtained from cobbles of glacial origin or other unidentified local sources. The basalt identifications require further substantiation through thin-sectioning.

A total of 120 lithics were found in the 1983 testing program. Basalt made up 39.2 percent of this total, while quartzite, siltstone and chert together composed 51.6 percent. Chalcedony, mudstone, quartz crystal, ironstone and obsidian comprised the remaining 9.2 percent (Table 8).

The 1984 testing program produced 819 lithic items. Quartzite accounted for 68 percent, while chert, mudstone, basalt and siltstone collectively made up 27 percent. Quartzose, chalcedony, ironstone, petrified wood, obsidian, massive quartz and quartz crystal each comprised less than 2 percent (Table 8).

Quartzite accounted for 75 percent of the 5,135 artifacts found in the 1984 block excavation. Of the remaining material types, mudstone (9.4%), siltstone (5.9%), basalt (3.2%), chert (3.1%), and chalcedony (1.8%) form significant portions of the collection. Quartzose, ironstone, quartz crystal and massive quartz each form less than one percent of total lithics (Table 8). The local availability of quartzite and quartzose (commonly found around the lake shore) probably accounts for both the relative abundance of these material types and the high incidence of cortex-bearing and utilized flakes.

Table 8. Percentage totals of lithic raw materials, Patricia Lake site.

Lithic Raw Material	Operation 1 #	Operation 1 %	Operation 2 #	Operation 2 %	Operation 3 #	Operation 3 %
Quartzite	3852	75.0	25	20.8	557	68.0
Basalt	166	3.2	47	39.2	64	7.8
Chert	159	3.1	13	10.8	77	9.4
Mudstone	481	9.4	3	2.5	60	7.3
Siltstone	300	5.9	24	20.0	21	2.6
Chalcedony	94	1.8	3	2.5	4	0.5
Quartzose	33	0.64			7	0.9
Quartz Crystal	16	0.31	2	1.7	10	1.2
Massive Quartz	14	0.27			14	1.7
Ironstone	20	0.38	2	1.7	2	0.2
Petrified Wood					2	0.2
Obsidian			1	0.8	1	0.1
Total	5135		120		819	

The two black, banded obsidian flakes found at Patricia Lake were analyzed using the X-ray fluorescence facilities at Simon Fraser University. The results indicate that both came from the Mount Edziza Flow #3 (see James, this volume). Mount Edziza is located some 950 km to the west of the Patricia Lake site.

Fifteen complete and incomplete projectile points were found at the Patricia Lake site. Eight (53%) were manufactured from chert, two from basalt and two from quartzite. Mudstone, siltstone and chalcedony each accounted for one point. Apparently chert was the lithic raw material preferred in the manufacture of projectile points.

Fourteen complete and incomplete bifaces were found; eleven were made of quartzite; one was made of quartz crystal; and chert and siltstone each accounted for one specimen. Of the six endscrapers, four were made of chert and one each was made of chalcedony and siltstone.

SUMMARY AND INTERPRETATIONS

Archaeological investigations were conducted at the Patricia Lake site over a four week period in the fall of 1984. The preliminary results of systematic testing (Operation 3) and limited block excavation

(Operation 1) suggested that the site is non-stratified. By tabulating lithic material types with the SPSS computer package Crosstabs and mapping the location of major material types with the computer mapping package Surface II, an attempt was made to separate lithic distributions into horizontally discrete cultural units. Three areas, where relative proportions of lithic material types differed significantly, were recognized with this method. These areas have been interpreted as being either different temporal occupations, different activity areas, or perhaps a function of sampling. Further field investigations and data manipulation beyond the scope of this project are required to confirm and determine the differences between the three perceived clusters.

Analysis of the Patricia Lake lithic assemblage confirmed the presence of a varied collection composed of morphologically distinct projectile points (stemmed, side-notched, corner-notched and indeterminate forms), bifaces, gravers, scrapers (end, side, and end and side), graver/scrapers, a microblade core and significant amounts of debitage. Quartzite was the most abundant lithic raw material type, but siltstone, mudstone chert and basalt formed a significant proportion of the material types used for formed tool manufacture. Non-local materials found at the site included obsidian and basalt (the identification of basalt lithic raw material was based on visual criteria and requires further study). The source of obsidian was determined to be Mount Edziza, some 950 km west of the Patricia Lake site.

The cultural affiliation and chronological placement of prehistoric occupations at the Patricia Lake site was difficult to determine due to the lack of radiometric and stratigraphic control. These problems were further compounded by the lack of a regional cultural sequence for the park area. With this in mind, a few tentative ideas can be put forth about the cultural affiliation of the Patricia lake site. Rousseau (1984:167) recognized three sequent cultural horizons for the Canadian Plateau in the last 4,000 years: the Shuswap Horizon (ca. 4,000 to 2,400 years B.P.), the Plateau Horizon (ca. 2,400 to 1200 years B.P.) and the Kamloops Horizon (ca. 1200 to 200 years B.P.). The Canadian Plateau was defined as the "territory in southern British Columbia between the Coast Mountains on the west, the international boundary to the south, and the Rocky Mountains to the east" (Rousseau 1984:150). The northern boundary was approximated at the big bend of the Fraser River to the northeast and just north of Stuart and Babine Lakes to the northwest. The Patricia Lake site is located 20 km east of Yellowhead Pass, in close proximity to the western boundary of the Canadian Plateau Culture Sub-area.

The Shuswap Horizon was defined as the first cultural horizon in which semi-subterranean pithouses were used as winter residences and was associated with points classifiable as Oxbow, McKean, Duncan, Hanna and other stemmed shouldered variants. Rousseau states that:

> ... the stemmed varieties are rare in assemblages dated earlier than 3000 B.P., in which the plains types dominate. Oxbow and McKean points do not appear later than 2900 B.P., while Hanna and Duncan points are found up to 2400 B.P. After 2900 B.P. the stemmed points dominate assemblages (1984:156, 157).

Rousseau (1984) defined the Plateau horizon (2,400-1200 years B.P.) as consisting of typically barbed projectile points, occasional stemmed points, spall scrapers, increased use of key-shaped perforator/gravers, fluorescence in lithic reduction and forming techniques, and use of pithouses, among other traits. Finally, the Kamloops Horizon (1200-200 years B.P.) was defined by primarily the Kamloops side-notched point, ground stone and housepits (see Rousseau 1984:167-173).

In terms of tentative comparisons, the Patricia Lake site would seem to be culturally and temporally affiliated with the Shuswap and Plateau Horizons of the Canadian Plateau. This interpretation is based on site microlocation (i.e., lakeshore) and macrolocation (i.e., geographically close to the Plateau area) and the presence of stemmed points with parallel to contracting bases, barbed points, obsidian from the British Columbia Interior (Edziza) and other lithic raw materials and artifact types (basalt, microblade core, split pebble, burinated point). This interpretation should be developed as a major hypothesis to be tested by further research. The excavation of a stratified prehistoric site in the Park would also be of use in resolving the question of cultural affiliations.

Research undertaken on the Patricia Lake site demonstrated that the multistage historical resource impact assessment consisting of site location followed by site assessment both in the field and through analysis prior to mitigative excavation is highly desirable. Although multistage programs have been the ideal, in most conservation archaeology various constraints have resulted in the two stage program of site location followed by mitigation. Assessment of significance is often done on highly intuitive or highly arbitrary grounds rather than through any real assessment of the site or the data. The use of computer software packages such as SPSS and Surface II can expedite the assessment stage. The use of multistage historical resources impact assessment is strongly recommended.

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SITE CLASSIFICATION AND PREHISTORIC SETTLEMENT SYSTEMS IN THE UPPER ATHABASCA RIVER VALLEY

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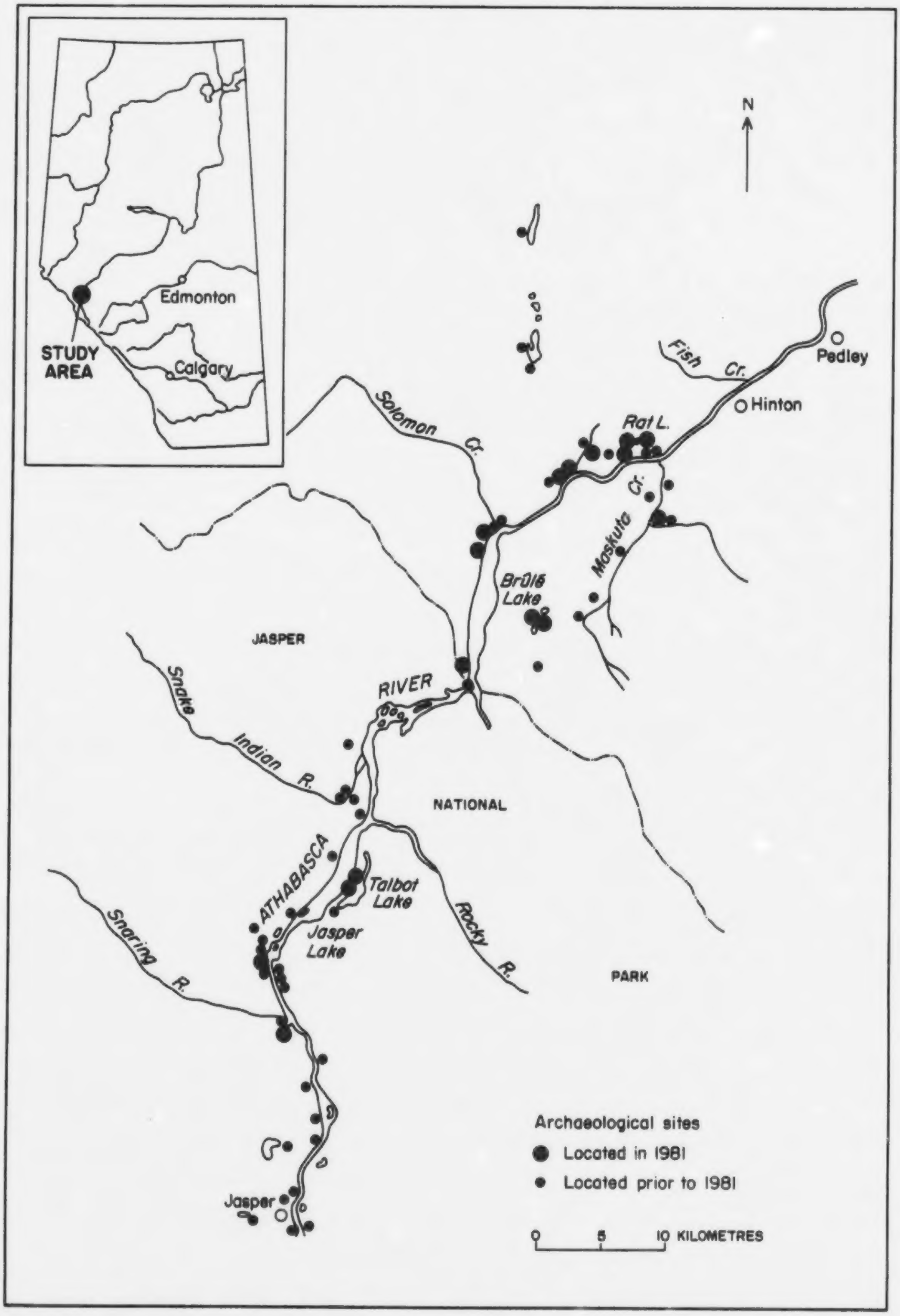
INTRODUCTION

An archaeological survey of a portion of the Athabasca River valley was undertaken to investigate the potential of the area to provide key information about its prehistoric use and to characterize the archaeology of the region in general terms. The area covered by the survey lies between the towns of Jasper and Hinton in the central Eastern Slopes region of Alberta (Figure 58). Since it is a major transportation route through the Rocky Mountains today, it is reasonable that this area would have been used similarly during prehistoric times and that such use would be reflected in the archaeological record. This report outlines the results of survey work carried out during the summer of 1981.

THE STUDY AREA

The study area, generally referred to as the Athabasca River valley, is situated in the west central portion of the province, between the towns of Jasper, in Jasper National Park, and Pedley, a railway station located just east of Hinton. The Athabasca River valley in this area of the province is described as "a broad, regional depression ranging from 15 to 20 km in width, with a local relief ranging from about 300 to 525 m" (Dumanski and Pawluk 1971:352-353). The valley is generally flanked by Kame terraces and it cross-cuts three major physiographic units: the Rocky Mountain front ranges, the Rocky Mountain foothills and the Interior Plains (Roed 1975:1494). A further physiographic division characterizes the valley as Athabasca Benchlands (Roed 1975:1494).

Surficial deposits consist of glacial tills. The most recent, termed Obed till, is a Cordilleran till which originates from the front and main ranges to the west of the valley. In localized areas these tills



Edmonton
Calgary
STUDY AREA
N
Fish Cr.
Pedley
Hinton
Solomon Cr.
Rat L.
Maskuta Cr.
Brûlé Lake
JASPER
RIVER
Snake Indian R.
NATIONAL
ATHABASCA
Talbot Lake
Jasper Lake
Rocky R.
Snaring R.
PARK
Jasper
Archaeological sites
● Located in 1981
● Located prior to 1981
0 5 10 KILOMETRES

Figure 58. The Athabasca River valley study area.

are overlain with outwash terraces and lacustrian silts and clays (Dumanski and Pawluk 1971:353). The present course of the river and the existing terrace features were established during the recession sequence of the Obed ice sheet (Roed 1975:1510-1514). This last period of deglaciation is thought to have occurred approximately 11,000 years ago (cf., Luckman and Osborn 1979; Roed 1975); however, the glacial chronology and recession sequences are not well understood in this area. Based on dated sequences in the Peace River and Banff areas, Luckman and Osborn estimate a minimum age of between 11,500 and 12,500 years B.P. for the retreat of the Obed ice (1979). But recent dates of ca. 14,000 years B.P. and earlier from a pollen core recovered from the Nordegg area suggest that deglaciation in this region may have occurred earlier than 11,000 years B.P. (Schweger, personal communication 1984).

In various places and to varying degrees, the glacial deposits are overlain by calcareous aeolian material. This aeolian deposition is one of the salient characteristics of the valley, and deposits are known to occur up to 60 m thick in some areas (Roed 1968). Aeolian activity is ongoing and is most noticeable along the eastern shores of Jasper Lake, in the vicinity of Talbot Lake and along the southern and eastern shores of Brule Lake. These deposits originate from the load of the Athabasca River. Sands and silts are deposited along the shores when the river is in flood and, subsequently, when the water recedes from the flood plains, the materials are picked up by the prevailing winds and deposited elsewhere forming "elongate blow-outs and parabolic dunes" (Dumanski and Pawluk 1971:353).

Throughout the study area, the most common tree species are aspen, white spruce and, to a lesser extent, lodgepole pine, which occur in areas of well-drained soils. In addition, stands of black spruce mixed with white spruce and balsam poplar are found in discrete, poorly drained topographic depressions (Dumanski and Pawluk 1971). In other parts of the study area, the combination of aeolian deposits, strong prevailing winds, low precipitation and nutrient-poor regosolic soils result in semi-desert grassland vegetation which is highly susceptible to erosion.

PURPOSE OF STUDY

The primary objective of the project was to investigate the potential of the upper Athabasca River valley to provide data about the prehistoric use of the area, more specifically, its potential as an important transportation focus during prehistoric times. Secondarily, the project was intended as an initial stage of subsistence and settlement investigation for this portion of the Eastern Slopes. Efforts in the field were directed at examining likely areas between Jasper and Hinton and at relocating and testing previously located and newly recorded sites to establish their general size and functional nature.

METHODOLOGY

Site survey was accomplished through simple visual examination of the ground surface with subsurface testing in areas of low visibility or at locations where artifacts were found. In general, subsurface testing was not the primary mode of survey and site discovery (a program of shovel testing was carried out at FgQm-6 for a separate research project; see Nance and Ball 1986). The amount of area actually covered in the survey was governed by the available field time and crew size; therefore, not all portions of the study area were surveyed. Survey areas were priorized on the basis of previous examination, potential, access and disturbance. As a result, because of the size of the study area, those regions which were believed to hold the greatest potential were surveyed first and those which were believed to contain less potential or had poor access were either covered less intensively or not at all.

Once discovered, sites were tested to establish their physical dimensions and the general nature of the materials present. Testing was undertaken in a number of ways. At sites where the limits were defined by topography, test unit locations were judgementally selected on the basis of the topographic characteristics of the feature upon which the site was situated. Where the site area was not restricted (for example, on river terraces), test units were excavated systematically outward from the area of initial discovery until materials were no longer revealed. Materials from all excavated units were screened using .65 cm mesh. In all cases, an attempt was made to recover either a representative sample or all of the cultural material present.

Materials collected during the Athabasca survey were grouped into broad functional types. In an effort to compare our site data with that of Elliott (1970-71) and Anderson and Reeves (1975), artifacts were classed under the following categories: core, flake, shatter, unifacially modified flake, bifacially modified flake, scraper, end scraper, biface and projectile point.

PREVIOUS RESEARCH

Previous research in the study area includes both inventory work carried out in the early 1970s and cultural resource management (CRM) studies undertaken within the last few years. In 1970 and 1971, portions of the Jasper National Park were surveyed by the Department of Archaeology, University of Calgary (Anderson and Reeves 1975; Elliott 1970-71). These surveys resulted in the recording of 102 historic resource sites in and adjacent to the park. More recently, there have been several CRM surveys and excavations in the general region associated with oil, gas and coal development projects. For example, Losey (1981a, 1981b) surveyed three subdivision lots near the town of Hinton, and Pollock (1981, 1982) also surveyed subdivision developments in the Hinton area. Losey's work (1981a) resulted in the recording of four historic resource sites, and Pollock's work (1982) resulted in the discovery of an additional four sites. None of these sites was felt to hold much importance in that no diagnostics were recovered from the tests and no cultural stratigraphy was noted.

Outside the survey area, to the north of Hinton, sites have been recorded in Switzer Park (Brink 1979; Thompson 1973) and to the east in the uplands above Fish Creek by Damp and Reeves (1981). Switzer Park was surveyed prior to 1973 by Elliott and Anderson (Thompson 1973:54). Thompson (1973:54-56) recorded a total of eight historic and five prehistoric sites in and around Switzer Park, but he notes that he was unable to relocate two of the previously recorded prehistoric sites. During 1979, Brink examined one of the areas surveyed by Thompson and Elliott and suggested that FiQk-15, 16 and 17 would be more accurately considered one site (Brink 1979:29). Brink (1979) identified five additional sites within the park along the southwestern shore of Gregg Lake. Damp and Reeves (1981) reported the occurrence of six prehistoric sites in the uplands north of Hinton and east of Switzer Park.

South of the study area, there have been a host of CRM studies undertaken in the last decade, most associated with coal mine development. Results of these studies indicate that this portion of the foothills was extensively used during prehistoric times. Unfortunately, the nature of the work carried out thus far precludes definitive interpretation. The majority of sites have been described variously as small, single component and limited activity areas.

With respect to the study area covered by this report, the most relevant of the work carried out to date is that of Elliott (1970-71) and Anderson and Reeves (1975).

REVIEW OF SITE CLASSIFICATION IN THE STUDY AREA

In the study of regional settlement patterns, it is often prudent and not without reward to review the results and interpretation of previous research. The work reported by Anderson and Reeves (1975) is both the most relevant and the only comprehensive attempt at defining the prehistory of the study area. The following review looks at the classification of site types used by Anderson and Reeves (1975) and, in so doing, outlines what is known of the prehistoric subsistence and settlement systems of the study area.

The identification of site type or site classification is one of the basic interests in archaeological research. In settlement system analyses, site classification precedes most other higher analytical goals and, logically, the classification of site type follows the classification of the artifacts (cf., Chang 1968; Rouse 1968; Whallon 1982; Willey 1968).

> For procedurally it is impossible to define a meaningful prehistoric settlement pattern unless one begins with the unit of a cultural complex; and cultural complexes are defined by the clusterings or association of artifacts and remains at given points in space and time. Once such complexes are known, through the procedures of recovery and classification, it is

> possible to correlate settlement features into patterns that represent, or are the residues of, former social institutions. Before this is done, the individual settlement features are no more to us than bumps or marks upon the landscape - lacking cultural identification, chronological position, or functional significance (Willey 1968:209).

Thus, identification and classification of site types are considered to be the key to the definition of prehistoric settlement patterns and are almost totally dependent upon a detailed analysis and classification of the artifacts which comprise the sites. Moreover, it is generally accepted that a classification system should be governed by a specific objective rather than attempt to be all encompassing.

> There seems to be a general agreement among these authors (Movius et al. 1968; and, Sackett 1965, 1968) that the present systems of artifact classification attempt to fulfill too many functions and as a consequence do none of them well. They attempt: 1) to classify artifacts according to primary morphological components; 2) to provide a systematic nomenclature; 3) to indicate a degree of ethnic affinity between assemblages; 4) to isolate broad technological facies; and 5) for some, to identify general functional or activity aspects of the tools and assemblages (Fish 1979:22).

Usually, such classification systems are formulated from a selected set of morphological traits and these traits ultimately dictate the form of the results of the analysis. Thus, classification is the grouping of artifacts into classes or types, each defined by a mutually exclusive set of morphological attributes or variables. These classes become the conceptual units upon which a final interpretation is based; therefore, the meaning of a classification system is highly dependent upon the choice of attributes used in the definition of the system (Rouse 1968; Whallon 1982).

Two forms of classifactory interpretation are in general use. One can be termed "functional," the other "stylistic." While a detailed discussion of the merits of either approach is beyond the scope of this report, it is important to note that they are applied by various researchers with varying degrees of "reliability." For example, while some archaeologists assume that some traits are the direct result of either stylistic or functional factors, others argue that it is necessary to first demonstrate those relationships (cf., Close 1977; Fish 1979).

In the above discussion, it is noted that in current theory the classification of site type is highly dependent upon the classification of artifacts and that the interpretation of the artifacts is dependent upon both the selection of specific classification traits and an understanding of the relationships those traits have with the problem at hand. Characteristically, this relationship could be either functional or stylistic. It is also noted that classification is highly individualistic, ultimately based on intuitive notion, and lacks a discipline-wide definition (Whallon 1982). Despite the theoretical and methodological difficulties that exist, classification is routinely carried out with minimal concern about the consequences of the typology used. This problem is not unique and is apparent in many archaeological studies (cf., Read 1982). With regard to the study area, some of the difficulties inherent in site type classifications are exemplified in work undertaken previously (Anderson and Reeves 1975; Elliott 1970-71).

As noted above, the Jasper National Park survey was originally reported by Elliott (1970-71) in two preliminary reports and, subsequently, by Anderson and Reeves (1975) in a more comprehensive volume. Because the latter volume incorporates the same data as the two earlier versions and constitutes a final report for the Jasper Park Survey project, further references in this project will be limited to Anderson and Reeves (1975).

Anderson and Reeves' work resulted in the reporting of 91 prehistoric sites; 50 were located within park boundaries and 41 outside the park area. The materials collected from each site are classified and a discussion is presented of past native culture history and settlement. It is the relationship between the materials and the site type nomenclature which is of interest here. The site typology used is defined as being:

> ... based on what the writer considers to have been primary activities occuring at an activity loci, as evidenced by the artifact assemblage, the density and extent of cultural refuse, and associated environmental variables, such as topographic location, climatic exposure, access to water, etc. (Anderson and Reeves 1975:153).

From this statement, it appears that the site classification system used is based on a functional analysis of the artifacts combined with certain environmental variables. However, since no specific associated environmental variables are presented or discussed in the report, it must be assumed that environmental variables do not play an important role in the final interpretation of site types and that the artifacts are the prime factor.

Twelve different site types are identified by Anderson and Reeves (1975). Of the fifty sites reported in the study area, six are classified as "isolated finds," six as "small campsites," twelve as "campsites," two as "base campsites," one as a "small transitory camp," one as a "transitory camp," one as a "workshop," twelve as "small workshops," one as a "game lookout," one as a "lookout," six as "lookout/workshops" and one as a "cave" site.

Following the previous discussion regarding the determination of site type from assemblage characteristics, it is supposed that similar site types may be defined by the occurrence of similar artifact types. Using the artifact typology provided by Anderson and Reeves (1975:169-172), assemblages were compared and grouped together using a simple cluster analysis routine. In such an analysis, it was reasoned that clusters of sites would be defined by assemblage characteristics. A total of 45 sites and 14 artifact types were used for this analysis. Seven sites were not included; these were sites identified as six isolated finds and one a cave site, which lacks a description of the artifacts collected or present. The artifact types and site types used in the analysis are listed in Table 9.

The phenogram from the cluster analysis is shown in Figure 59. Table 9 lists the raw data used for the cluster analysis, but reordered from the results of the analysis. Two patterns are immediately obvious in the results of this analysis. The first is that, within the clustered groups, considerable mixing of site types occurs. Second, the majority of sites display only minimal degrees of similarity; that is, for the most part the sites link together at rather low levels. A comparison of the site groupings shown in Figure 59 and Table 9 highlights the mixture of site types. Based on their artifact content, FfQm-5 and FiQo-17 in Group 1 appear most similar, but FfQm-5 is classed a "campsite" and FiQo-17 is termed a "small workshop." The remaining two sites in

Table 9. List of artifact frequencies for sites recorded by Anderson and Reeves (1975). Sites are grouped as shown in the results of the cluster analysis (Figure 59).

Similarity Group	Site Number	Site Type	Artifact Types 1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL
1	FdQl 1	CS		14	26		1	1							1		43
	FfQm 5	CS		5	8		1						1				15
	FiQo 17	SWS	1	1	1		1										4
	FgQm 8	LO/WS	2	1	2										1		6
2	FeQl 2	WS		5	11								1				17
	FiQo 9	SWS		2	9								1				12
	FiQo 12	Oo/WS	1		2								1				4
	FgQm 14	LO	1	4	5	2		2					3				17
	FgQm 6	BCS	6	55	194	2	1	3		4		4	4	1	2		275
3	FfQm 4			1				1									2
	FgQm 3	G/LO		2	2												4
	FgQm 7	LO/WS		2	1												3
	FiQo 23	SWS		2	4												6
	FgQm 5	WS		3													3
	FiQo 1	IF			2												2
	FiQo 6	STC			3												3
	FiQo 7	SCS		1	4												5
	FiQo 14	TC		6	9												15
	FiQq 22	SWS		6	6												12
	FiQo 21	LO/WS		3	9												12
4	FgQm 13	SWS	1	3	7												11
	FiQo 10	SWS	1	16	18												35
	FiQo 4	CS	3	3	19							1					26
	FiQo 13	SWS	2	5	14												21
	FiQo 18	SWS	2	4	6												12
	FiQo 15	LO/WS	3	11	10												24
	FiQq 2	SWS	4	15	30												49
	FiQp 1	CS	6	25	43												74
	FiQo 16	SWS	3	1													4
	FiQq 21	SWS	3	2	1												6
	FiQo 24	SWS	3	1	5												9
	FiQq 20	SWS	4	4	11										19		
5	FfQk 1	CS						1									1
	FgQm 2	CS						1	1								2
	FiQo 3	SCS						1	1								2
	FgQm 1	CS		6	4	1	1	2									14
	FfQm 6	CS	4	4	16		1	1			2	2					30
	FgQm 12	CS						1			2	1					14
	FfQm 2	CS	1						1								4
	FiQo 19	SCS		1	1				1								3
	FiQo 22	SCS	3		13				1								17
	FfQm 7	?								1	1						2
	FfQm 9	CS							1	3	3						7
	FiCo 8	BCS	2	6	31				1		2						42
	FiQp 3	SCS			6						1						7

1 - Primary & secondary decortication flake
2 - Flakes
3 - Flake Fragment
4 - Cove Fragment
5 - Utilized Flakes
6 - Retouched Flakes
7 - Chopping Tools
8 - Scraping Tools
9 - Unifaces
10 - Bifaces
11 - Projectile Points
12 - Drills
13 - Gravers
14 - Shell

IF - Isolated Finds
SC - Small Campsite
CS - Campsite
BSC - Base Campsite
STC - Small Transitory Camp
TC - Transitory Camp
WS - Workshop
SWS - Small Workshop
GLO - Game Lookout
LO - Lookout
LO/WS - Lookout/Workshop

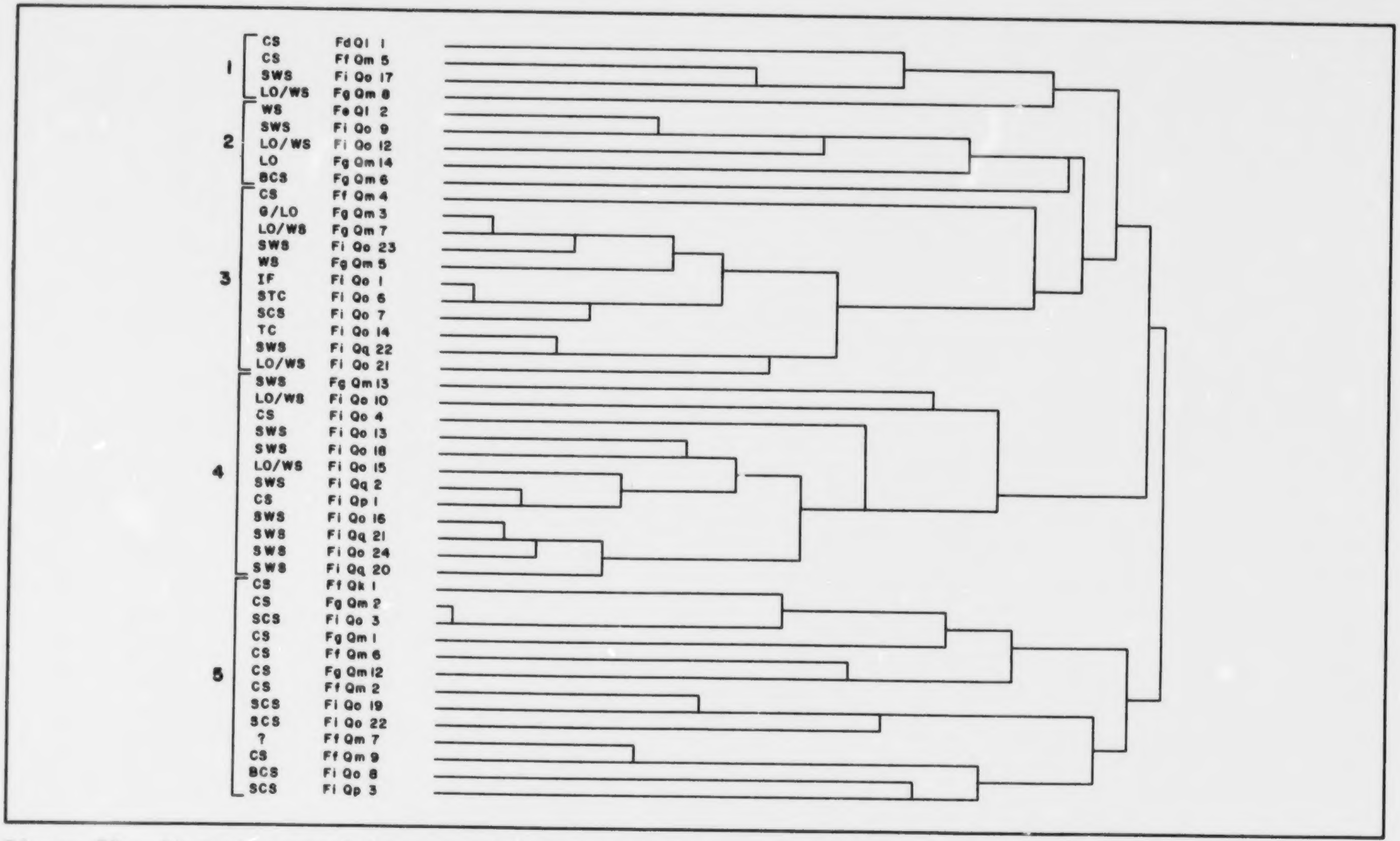

1
CS FdQl 1
CS Ff Qm 5
SWS Fi Qo 17
LO/WS Fg Qm 8
2
WS FeQl 2
SWS Fi Qo 9
LO/WS Fi Qo 12
LO Fg Qm 14
BCS Fg Qm 6
3
CS Ff Qm 4
G/LO Fg Qm 3
LO/WS Fg Qm 7
SWS Fi Qo 23
WS Fg Qm 5
IF Fi Qo 1
STC Fi Qo 6
SCS Fi Qo 7
TC Fi Qo 14
SWS Fi Qq 22
LO/WS Fi Qo 21
4
SWS Fg Qm 13
LO/WS Fi Qo 10
CS Fi Qo 4
SWS Fi Qo 13
SWS Fi Qo 18
LO/WS Fi Qo 15
SWS Fi Qq 2
CS Fi Qp 1
SWS Fi Qo 16
SWS Fi Qq 21
SWS Fi Qo 24
SWS Fi Qq 20
5
CS Ff Qk 1
CS Fg Qm 2
SCS Fi Qo 3
CS Fg Qm 1
CS Ff Qm 6
CS Fg Qm 12
CS Ff Qm 2
SCS Fi Qo 19
SCS Fi Qo 22
? Ff Qm 7
CS Ff Qm 9
BCS Fi Qo 8
SCS Fi Qp 3

Figure 59. Phenogram resulting from cluster analysis of 45 site assemblayes reported by Anderson and Reeves (1975). Data were standardized. The product moment distance coefficient and a weighted average clustering algorithm were used in the analysis.

Group 1, FdQl-1 and FgQm-8, link onto the two higher correlated sites at relatively low levels.

The sites in Group 2 similarly show relatively low correlation levels. FeQl-2 and FiQo-9 are most highly correlated, with similarity resulting from three shared artifact types. FeQl-2, with a total assemblage of seventeen artifacts, is termed a "workshop," and FiQo-9, with twelve artifacts, is a "small workshop." FiQo-12 (a "lookout/workshop" with four artifact types) links with FiQo-9 and FeQl-2 at a lower level, sharing similarity in just two of the three artifact types occurring at FiQo-9 and FeQl-2. FgQm-14 (a "lookout" with seventeen items) and FgQm-6 (a "base campsite" with 275 items) join the other three sites in this group at even lower correlation levels. Their link with FeQl-2, FiQo-9 and 12 occurs as a result of shared similarity in artifact types 1, 2, 3 and 11. Therein, they are more similar to sites in Group 2 than any other sites, although this similarity is low.

Unlike sites in Groups 1 and 2, Group 3 sites show considerable correlation. The basis of this correlation is the occurrence of only two artifact types (2 and 3) at most sites. As with other groups, there is considerable mixture of site types despite the similarity of artifact types.

The sites in Group 4 have three artifact types in common, with the exception of FiQo-4 which has projectile points in addition to the other types. All sites are classed as "small workshops" except for FiQo-4 (a campsite), FiQo-15 (a lookout/workshop) and FiQp-1 (a campsite). While this is the most consistent group of those identified, it is interesting to note that FiQp-1 is called a campsite even though it shows great similarity to others which are termed "small workshops." Similarly, FiQo-4 and 15, which appear in their assemblages to be more like sites termed "small workshops," are classified as a "campsite" and a "lookout workshop," respectively.

Like those in Groups 1 and 2, most of the sites in Group 5 display low levels of similarity. The exceptions are FgQm-2 (a campsite) and FiQo-3, (a "small campsite"). Both consist of two artifacts: a chopping tool (type 7) and a scraping tool (type 8) and are thusly identical. FiQo-8 is called a "base campsite" with five artifact types and a total of 42 items. FfQm-6, with seven types, shows greater richness in artifact types than does FiQo-8. FfQm-7 consists of a total of thirty artifacts and is called a "campsite." FfQk-1, with a single artifact to signal its presence, is called a "campsite." While FfQk-1 does cluster with other sites termed "campsites," it remains puzzling how the occurrence of a single isolated artifact can be interpreted as a "campsite."

From the above analysis, it seems reasonable to suggest that very little in the typology has actually been used to differentiate distinct site types. Indeed, it is never stated what might be expected to occur and, therefore, to provide the differentiation in a "campsite" versus a "base camp," "lookout" or "workshop." Clearly, the variation in and distinction between site types is not a function of the analysis of the inherent qualities of the assemblages. Assumptions and intuitive perceptions remain the most likely factors to account for the resulting site typology. The interpretations of settlement patterns, therefore, must be considered unsubstantiated; settlement pattern interpretations are not supported by the data recovered in the survey.

What then of the interpretation of prehistory in the Athabasca-Jasper area? Anderson and Reeves state near the end of their report:

> The preceding discussion has briefly outlined the prehistory of the Park region, as reflected in projectile point types of known and unknown cultural affinity (1975:98).

Thus, the interpretation of the prehistory of the area is based primarily upon the occurrence and comparison of projectile point styles. Further, the occurrences of these various point types are presented as indications of the movement of different cultural groups in and out of the study area. While it certainly is possible that projectile points and other traits could be indicative of movements of culture groups within an area over time, a demonstration of this would require more supporting data than simply the presence or absence of particular point styles.

In summary, analysis of the data presented by Anderson and Reeves (1975) indicates that the current interpretation of the prehistory of the study area is founded primarily upon intuitive evaluations based on the presence of various projectile point styles. Determinations of site types are not consistently tied to the artifact assemblages which are present, nor are they actually related to the functional analysis outlined in the introductory text. Other than the presentation of an artifact typology and a listing of assemblages, nothing is done with the artifact types formulated. Lastly, while "environmental variables" enter into the conclusions, interpretations and explanations of Jasper prehistory, there is neither discussion nor analysis regarding the relationships between the sites and palaeoenvironments. We must conclude, therefore, that outside of speculation little is actually known of the prehistory of the study area.

1981 SURVEY RESULTS

The area covered by our 1981 survey is shown in Figure 58. Twenty-one new site locations were recorded and investigated, and five previously recorded sites were examined. Lists of raw material and artifact types by site are provided in Tables 10 and 11.

The majority of the newly recorded sites were small in both size and content, many consisting of a few flakes and a small number of bone fragments (see Table 11). None of the sites may be classified as being large in size or rich in material culture. Of the more interesting sites, FfQm-16 included a small side-notched point in its assemblage; FgQm-16 displayed the greatest diversity of both artifact and material types; and FhQl-4 appeared to show the greatest antiquity.

FhQl-4, situated on the west side of Brule Lake at Swan Landing, was found eroding from a cutbank apparently formed as a result of gravel and sand quarrying for road or railway construction. Cultural materials (lithics) were recovered from three different levels in the profile. These culture-bearing strata are contained within aeolian layers of sand which, in turn, lay upon a deposit of till. The culture-bearing deposits were identified at approximately 3.3, 2.6 and 1.6 m below surface (see Table 12). A total of 24 items were collected from this site. Some of these were recovered in situ from a test trench excavated into the bank to retrieve carbon samples for dating the deposits; others were collected from the exposed cutbank. The data shown in Table 12 result from a column sample which was taken from the site in 1983. In total, eleven flakes, four pieces of shatter, four unifacially modified flakes, two bifacially modified flakes, two projectile points and numerous small

Table 10. List of lithic raw material types recovered from sites in the study area.

	Quartzite	Quartz	Chert	Fossiliferous Chert	Mudstone	Siliceous Mudstone	Cherty Mudstone	Siltstone	Siliceous Siltstone	Calcareous Siltstone	Cherty Siltstone	Siliceous Cherty Siltstone	Clayey Siltstone	Silicified Cherty Siltstone	Calcareous Claystone	Cherty Limestone	Calcareous Sandstone	Feldspathic Sandstone	Feldspathic Siliceous Sandstone	Obsidian	Total
FfQm-11						1															1
FfQm-13			2				12		1												15
FfQm-14	4						1		1												6
FfQm-15	3	1	10							1	1	11									27
FfQm-16	1		4			2			219												226
FgQl-3			3	3					1				8								15
FgQm-6	12	1	26	5	6	9	15	2	4	5	1			8	25					1	120
FgQm-15			1		1																2
FgQm-16	18	15	13	19				8	17	2	22	63					1	1	4		183
FhQk-5	1					3			1												5
FhQk-6	6								1								1				8
FhQl-2	13		2	50												5					70
FhQl-3	3		3																		6
FhQl-4	10		13																		23
FiQj-1	10																				10
FiQj-2									3												3
FiQj-3																			1		1
FiQj-4	1			1					1												3
FiQj-5	2		1																		3
FiQk-4	1		1						1												3
FiQk-20							1														1
FiQk-21	7		6					2	3												16
FiQk-22	1		1																		2
FiQk-23			2	1	1				1												5
FiQk-24	1		1																		2
FiQk-25			2																		2
TOTAL	94	17	91	79	8	15	29	12	254	8	24	74	8	8	25	5	2	1	5	1	760

bifacially modified flakes, two projectile points and numerous small bone fragments have been collected from the site. The projectile points (Figure 60) were recovered from the lowest and most centrally located cultural levels.

Gastropod species were recovered from all levels except 13 and 14. Bone was present in levels 19, 21, 26, 26, 32 (rodent tooth) and 35. None of the bone was identifiable as to element or species. Charcoal was recovered from all levels except levels 4, 6-13, 15, 21, 23, 29 and 35. A sample of bark was collected from level 21. Radiocarbon estimates were obtained from five samples taken from levels 3, 21, 26, 32, and 33. The dates are: 1,870 ± 50 and 1900 ± 60 (AECV-7CX, two estimates were made on one sample) from level 3; 8,220 ± 90 (AECV-11CX) from level 21; 7,010 ± 1560 (S-2179) from level 26; 8,630 ± 100 (AECV-10CX) from level

Table 11. Number of artifact types recovered from sites in the study area.

	Shatter	Core	Flake	Unifacially Modified	Bifacially Modified	Scraper	End Scraper	Biface	Projectile Point	TOTAL	Bone Fragments	Burnt Bone Fragments
FgQl-3	4		11							15		
FhQk-5	1		3	1						5		
FhQk-6	1		7							8		
FhQl-2	20		48						1	70		9
FhQl-3			3	1			2			6		
FhQl-4	4		11	4	2				2	23		10
FiQj-1			9	1						10		
FiQj-2	1		2							3		
FiQj-3	1									1		13
FiQj-4	3									3		
FiQj-5	1		1	1						3		10
FiQk-4			2		1					3		
FiQk-20			1							1		
FiQk-21	1		17							18	11	
FiQk-22			1						1	2	1	
FiQk-23	1		3						1	5		
FiQk-24	1		1							2		35
FiQk-25	1		1							2		
FfQm-11			1							1		11
FfQm-13	2		13							15	3	5
FfQm-14			5			1				6		
FfQm-15	2	1	24							27		8
FgQm-15			2							2		
FgQm-6	48	1	67	2		2				120		9
FgQm-16	60	4	108	5		1	2	1	2	183		100
FfQm-16	73	4	125	6	10	6		1	1	226	2	
TOTAL	225	10	446	21	13	10	4	3	8	760		

Table 12. Column sample results from FhQl-4.

Level	Charcoal Wt. (g)	Lithics		Fauna		Other	Radiocarbon Estimate
		no.	Wt.(g)	type	no.		
1	18.6			snails	23		
2	28.9			snails	5		
				snails	285		
3	9.2			snails	203		1870 ± 50
							1900 ∓ 60
4				snails	38		
5	3.4			snails	8		
6				snails	26		
7				snails	137		
8				snails	68		
9				snails	18		
10				snails	13		
11				snails	17		
12				snails	2		
				snails	21		
13							
14	0.4						
15				snails	10		
16	0.8	2	0.1	snails	14		
17	13.0	3	0.1	snails	38		
18	11.8			snails	42		
19	1.1			bone/frags	1		
				snails	35		
20	6.4			snails	48		
21				bone/frags	1	226.8gm bark	8220 ± 90
				snails	74		
22	13.8			snails	86		
23				snails	234		
24	0.3			snails	52	3.1 gm seeds	
25	4.5			snails	53		
26	2.1	15	1.4	bone/frags	47		7010 ± 1560
				snails	72		
27	1.4	4	0.1	bone/frags	41		
28	0.2			snails	47		
29				snails	24		
30	0.2			snails	43		
31	0.2			snails	22		
32	3.7			snails	173		8630 ± 100
				tooth	1		
33	0.1	2	0.2	snails	269		8675 ± 270
				snails	55		
34	1.3			snails	38		
35				bone/frags	2		
				snails	26		

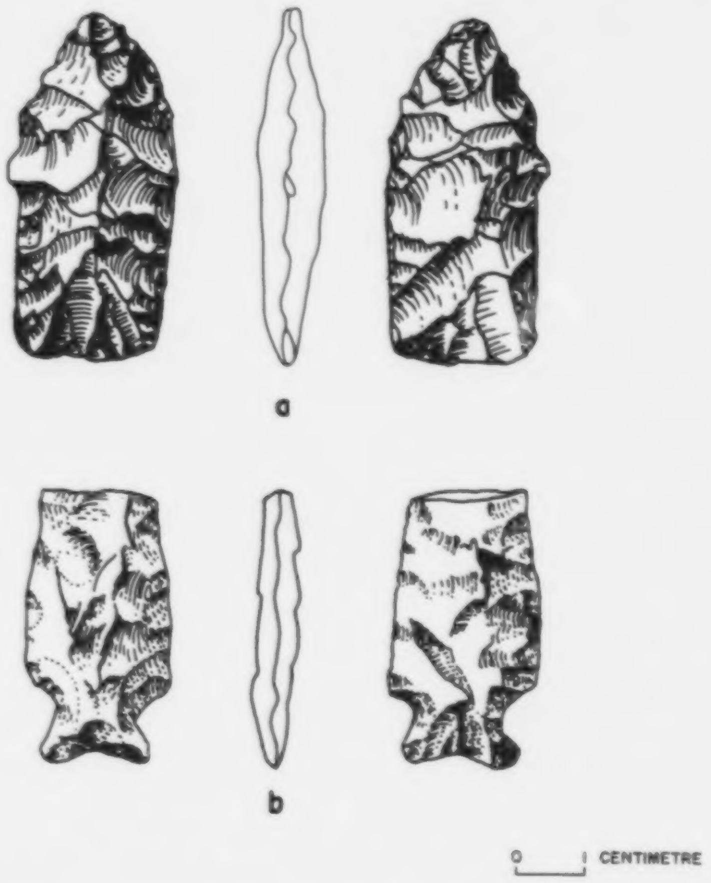


Figure 60. Projectile points from site FhQl-4, specimen (a) from level 33 and specimen (b) from level 26.

32; and 8,675 ± 270 (S-2178) from level 33 (see Table 12). All estimates were made on samples of charcoal except for AECV-11CX which was made on bark.

DISCUSSION AND CONCLUSIONS

The intent of this study was to determine the nature of prehistoric use of the Athabasca River between Jasper and Pedley and to generally characterize the archaeology of the region. A review of past research undertaken in the study area revealed incongruities between assemblage data and site type nomenclature with the result that the interpretations of the prehistory appear to be tenuous. The results of this review bring to light one of the primary difficulties in attempting to undertake functional interpretations of site type from the assemblage data base in this portion of the province, namely that the majority of sites consist of rather small number of lithic artifacts comprised mostly of classes of debitage.

Not surprisingly, our survey produced similar results. Most sites consist of small assemblages with equally small number of artifact types. This is clearly evident in both Figures 61 and 62 which show the distribution of artifact types and the number of artifacts plotted against sites for the Athabasca study and the Jasper Park study (Anderson and Reeves 1975), respectively.

Another characteristic of the assemblages which inhibits traditional site classification is apparent in the results of the analysis of Anderson and Reeves' data. The generally low levels of taxonomic correlation, shown in Figure 59, indicate the presence of high intrasite homogeneity or low intrasite variability . A quick review of artifact frequencies provided in Tables 9 and 11 reveals that the low intrasite variability apparent in Anderson and Reeves' data is also present in our data. In both data sets, there are but a few sites which display real variety within the assemblages.

Figure 63 shows a cumulative frequency plot of number of sites plotted against total number of artifacts for each of the surveys undertaken in the study area. On the basis of simple frequency data, the sharp rise in both curves, coupled with the gradual leveling out with the addition of the larger, more diverse assemblages, suggests the existence of two site types: (1) sites with few artifacts and few artifact types and (2) sites with greater number of artifacts and correspondingly more artifact types. Using diversity, in the sense that it refers to richness or assemblage variety, as a means to describe site variability, the overall pattern for the study area is one of low intersite diversity and low intrasite diversity. This pattern appears to be consistent with other northern regions of Alberta (Ives 1981).

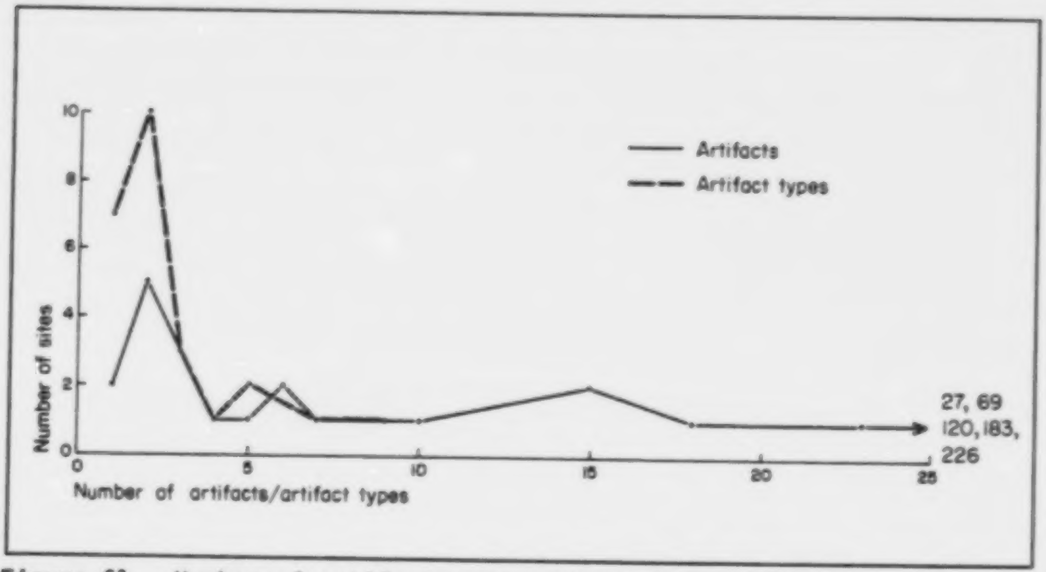


Figure 61. Number of artifacts and artifact types plotted against number of sites. Data from the Athabasca survey.

The difficulties inherent in analyzing such assemblages, as described above, are compounded by taphonomic processes and time factors which often can be neither detected nor controlled and make assemblage comparison and interpretation difficult, if not impossible. However, Binford's recent descriptions of Nunamiut subsistence and settlement patterns (1978, 1980, 1982) provide some interesting parallels for consideration which, at least partially, transcend temporal and depositional interpretive biases. Binford suggests that:

> When residential mobility is at a minimum the economic potential of fixed places in the surrounding habitat will remain basically the same, other things being equal. This means that a system changing in the direction of increased sedentism should generate ancillary sites with increasing content homogeneity. This should have the cumulative effect of yielding a regional archaeological record characterized by greater intersite diversity among ancillary or non-residentially used sites but less intrasite diversity arising in the content of multiple occupations (Binford 1982:20).

As outlined previously, the pattern which is manifest in the archaeological record of the study area is one of a preponderance of small assemblage sites. Figures 61, 62 and 63 describe the results of both surveys (ours and Anderson and Reeves' [1975]) and further suggest an apparent dichotomy of assemblage types characterized by a large number

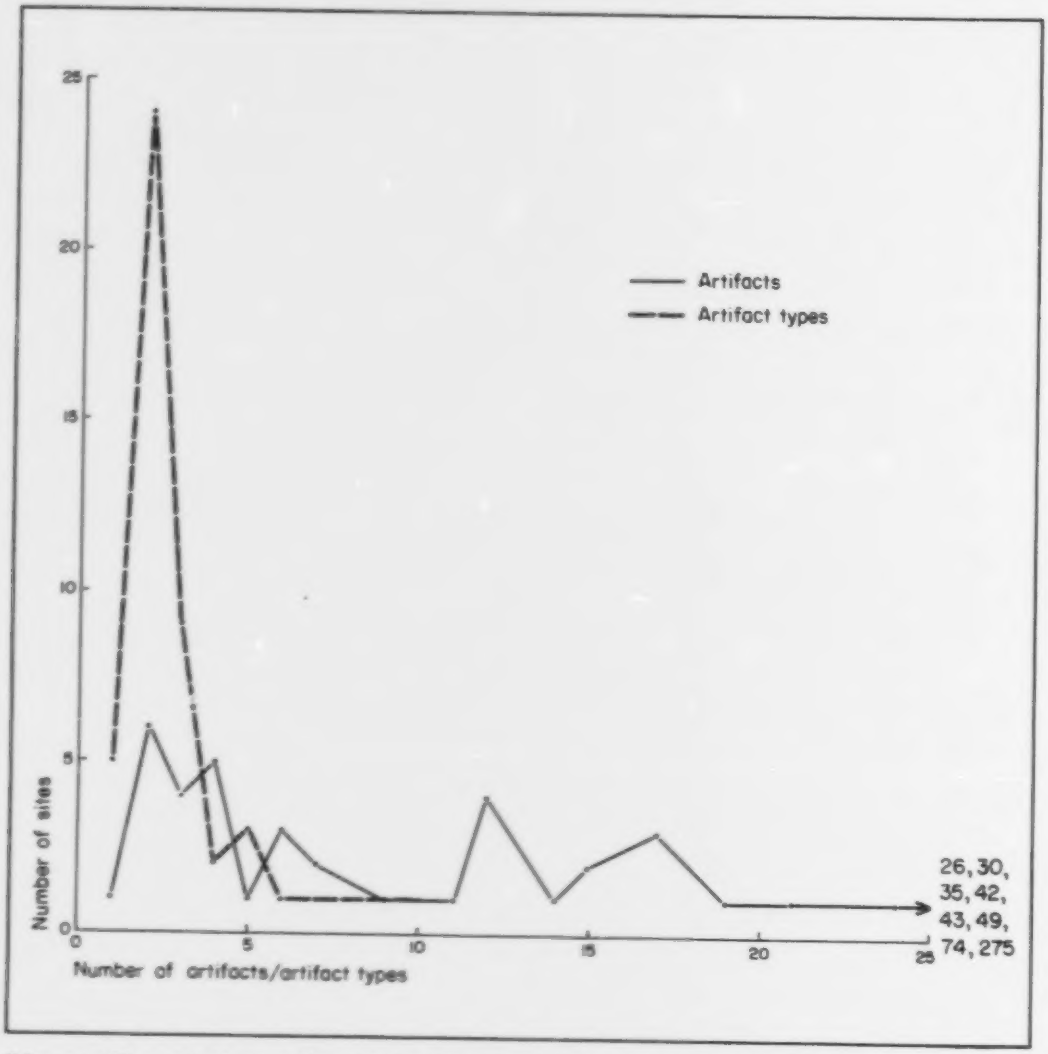


Figure 62. Number of artifacts and artifact types plotted against number of sites. Data from the Jasper Park survey, Anderson and Reeves (1975).

of small assemblage sites and a few apparently larger sites with more artifacts and types.

Following the results of recent ethnoarchaeological research and general hunter-gatherer foraging models (e.g., Binford 1978, 1980, 1982; Gould 1977; Jochim 1976; Winterhalder and Smith 1981; Wobst 1974, 1976), we may hypothesize a settlement and subsistence system characterized by a small number of base or "residential" camps, supported by a larger number of ancillary "logistical" sites. While our larger residential sites show

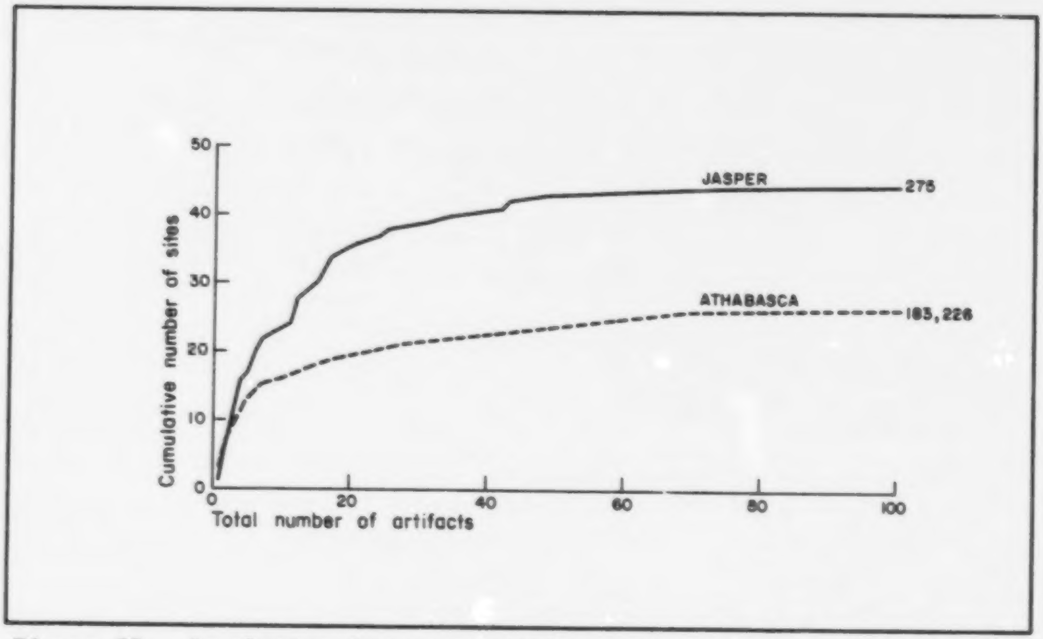


Figure 63. Cumulative frequency of plot number of sites plotted against total number of artifacts. The sharp rise in the curves shows the predominance of the small assemblage sites over the larger assemblage sites. Jasper data from Anderson and Reeves (1975; n=43). Athabasca data from this study (n=25).

increased variety in their assemblages, the overall pattern is one of homogeneity, that is, low intersite diversity and low intrasite diversity. This is at odds with Binford's (1982) model in which greater intersite diversity is expected. However, the observations that Binford makes are based on an ethnographic study in which almost the entire archaeological record could be expected to be present, and archaeological problems of time and taphonomy are almost nonexistent. On the other hand, the archaeological record of this study area is almost entirely restricted to lithics and nonartifactual faunal remains. It must be assumed that a considerable portion of the archaeological record has disappeared. If we accept the proposition that there exists a finite set of lithic artifact types, then it may be expected that continual re-use of sites over time will not effectively increase the diversity or variety in assemblage deposition. Such homogeneity of assemblages would produce both low intersite diversity and low intrasite diversity. While in reality, continued re-use of the small logistical sites resulted in increased depositional diversity, but factors of time and taphonomic processes deleted the perishable portion of the archaeological record; only the lithics remain showing up little variety in the assemblage. Where no lithics were deposited, little is left for discovery. Thus, in the case of sites occurring in regions such as the Athabasca-Jasper study area, where preservation is poor and the nature of the archaeological record is almost totally restricted to lithics, it may be presumptuous to suppose that it is possible to derive an accurate functional site type interpretation from the assemblage alone.

Use of a hunter-gatherer system model, such as Binford (1982) describes, perhaps provides a basis for more fruitful research. Such a foraging system appears to fit the patterns apparent in the archaeological record and, while a test of such a model is beyond the scope of this study, it appears to be the next most logical step. The determination of site type remains problematical. While it is obvious that there exists a large number of small sites and a small number of larger assemblages, at which point does a site become one or the other? All things considered, we simply may not be in a position to determine functional types or to identify residential as opposed to logistical sites.

In summary, the combined dating evidence from the projectile points and the radiocarbon estimates from FhQl-4 suggests a cultural history spanning some 9,000 years. Given the general homogeneity manifest in the site assemblages (as noted above), it may be argued that both subsistence and settlement over this time period were relatively stable. The argument against this concerns the suggestion that because there exists a finite set of lithic artifact types, the occurrence of cultural change and variability will be difficult, if not impossible, to identify. Certainly the lack of temporal control for the major sites, especially those with smaller assemblages, makes any attempt to compare intrasite variability and to suggest change through time difficult, and the results of such a comparison highly suspect. It is argued that the determination of functional site type classifications is questionable without well-defined artifact typologies, detailed analyses and demonstrated functional relationships between artifact and activity. It is further suggested that it may be unrealistic to presume that it is even possible to identify functional site types based on an analysis which is solely dependent upon lithics.

The introduction of different raw materials, artifacts or technology into the region could provide the opportunity to identify change in the archaeological record. Unfortunately, there exists little compelling evidence to support the idea that an immigration or incursion of different cultural groups into the area occurred. This is not to say that cultural changes did not occur. Rather, simply that, on the basis of present data, there is no evidence of significant cultural changes. The apparent stability of the settlement and subsistence system, as manifest in the artifactual inventory, is also apparent in the raw materials utilized. With the exception of a single piece of obsidian, all other raw materials were locally derived.

Thus, the evidence suggests that prehistoric use of the study area followed a hunter-gatherer foraging system similar to that described by Binford (1982). The unchanging artifactual record suggests this lifestyle may have continued unaltered for approximately 9,000 years of prehistory.

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AN INTRODUCTION TO THE ARCHAEOLOGY OF THE GRANDE CACHE REGION IN THE NORTH ALBERTA ROCKY MOUNTAINS

By

John W. Brink and Robert J. Dawe

Archaeological Survey of Alberta

INTRODUCTION

The region considered in this paper is the northern Alberta Rocky Mountains, from the Athabasca River north to provincial border in the vicinity of the Kakwa River valley. The northern Rockies are arguably the least studied and least known archaeological region in Alberta's mountain system. This report will attempt to redress this situation by reporting on the archaeological work conducted in the northern portion of this region during the years 1974, 1975, 1978 and 1979. This work includes surveys of major lakes and river systems and excavation of two sites. Due to the vast size of the northern Rockies and the fact that all of the studies reported herein are confined to the northern sector of this region, discussion will centre on that portion of the Rockies which will be referred to as the Grande Cache region (Figure 64).

THE STUDY AREA

The surficial geology of the study area is underlain by a thick succession of interbedded sandstone, silt-mudstone and coal. These deposits are of similar age and composition to the bedrock formation of the Edmonton-Red Deer area of central Alberta (Irish 1965). Most formations date to late Cretaceous and early Tertiary times. In general, the bedrock geology is quite complex. Surficial deposits in the study area are largely of glacial origin. It is clear that most parts of the Grande Cache region were glaciated at one or more times. Both continental and alpine glaciation have likely affected the area, with the latter subsequently modifying the land surface left by the former to produce the present land form. Glacial deposits in the study area consist of till, lacustrine sediments and glacial sands and gravels.

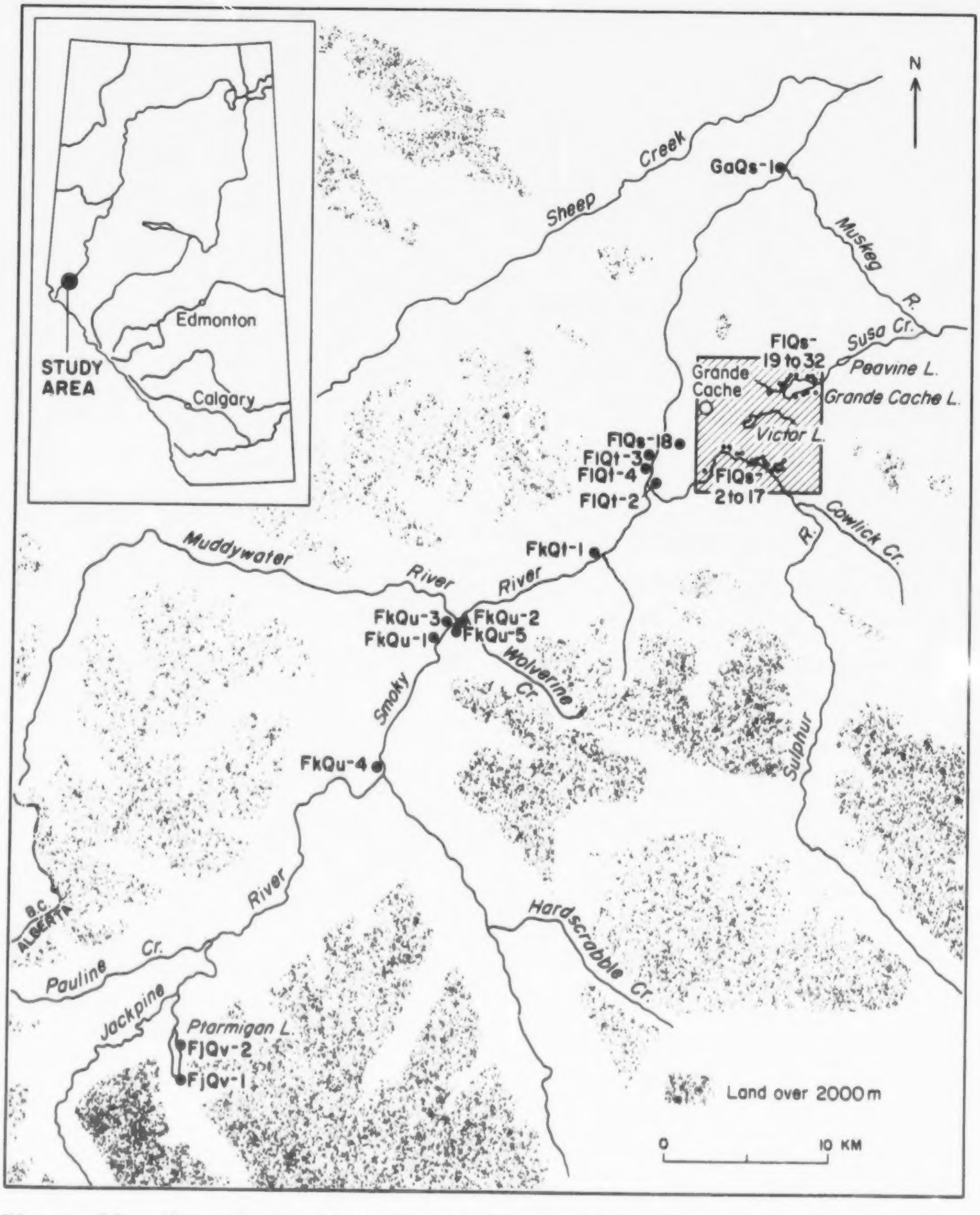

N
Sheep Creek
GaQs-1
Muskeg R.
Susa Cr.
FlQs-19 to 32
Peavine L.
Grande Cache
Grande Cache L.
Victor L.
FlQs-18
FlQt-3
FlQt-4
FlQt-2
FlQs-2 to 17
Cowlick Cr.
FkQt-1
Muddywater
River
River
FkQu-3
FkQu-2
FkQu-1
FkQu-5
Wolverine Cr.
Smoky
Sulphur R.
FkQu-4
River
B.C.
ALBERTA
Pauline Cr.
Hardscrabble Cr.
Jackpine
Ptarmigan L.
FjQv-2
FjQv-1
Land over 2000 m
0
10 KM
Edmonton
Calgary
STUDY AREA

Figure 64. Map of the study area. The shaded area is detailed in Figure 65.

Although the date for deglaciation in the Grande Cache region is unknown, it is probably safe to assume that glacial ice was basically gone from the region by at least 11,000 years ago (Fedje 1984; Fladmark et al. 1984; Rutter 1980, 1984; White et al. 1979).

Soils throughout the area are generally shallow and developed on a parent material of till or other glacial material. Such soils are often classed as grey wooded or podzolic. The B horizons of most soils throughout the area are quite acidic, with pH measured at 4 to 4.5. The most characteristic soil feature of the region is a buff-red to orange coloured Bf horizon composed of a fine, powdery silt. This deposit is of aeolian origin and consists primarily of silt-sized particles picked up from the dry, exposed portions of braided stream channels by the strong westerly winds.

The characteristic soil of the area has a thin (c. 5 cm) LFH and/or Ah horizon, a Bf horizon some 20 cm in thickness, and a silty and sometimes gravelly Cca horizon which may extend for many metres. In our experience, cultural materials were always contained in the reddish brown Bf horizon, with the exception of some historic items recovered from the leaf litter or in the Ah horizon. While in theory loess deposition and spring floods of creeks and rivers could produce buried and stratified sites, no such sites have yet been discovered.

All major rivers in the study area have adopted a trellised or braided pattern, with their orientation being northwest and northeast. Most rivers are fairly wide, relatively flat bottomed, and have gently sloping sides. However, valleys that parallel the strike of the geological formations (i.e., northwest) are usually more deeply incised with steeper valley walls than those which flow to the northeast. The major river in the study area is the Smoky River, which has several large tributaries (Figure 64). Smaller tributary streams throughout the region generally present a more dendritic pattern. In general, rivers and creeks are plentiful throughout the region, but lakes are generally scarce.

From northeast to southwest, the study area changes progressively from low, rounded, timbered hills to high, rocky, barren mountain ridges. Fire has historically played an important role in changing the vegetation cover and probably did so in prehistoric times as well.

Because of fire, few areas of mature or virgin spruce can be found. Instead, second growth dominates the whole area.

The most common trees throughout the area are white spruce, lodgepole pine and trembling aspen, with lesser amounts of balsam poplar and paper birch. At higher elevations, lodgepole pine, white and black spruce, Engelmann spruce and alpine fir prevail (Hosie 1969). Where poplar dominates, the country is often fairly open and grassy. Under the conifers. the mats of needles kill off most grass species. True grassland or extensive meadow areas are practically non-existent. Shrubs and herbs are common along lakes, rivers, creeks, disturbed areas and slopes with southern aspects.

Fauna of the Grande Cache region again presents a mixture of elements from the boreal forest and the mountains. Large mammals in the area include deer, moose, elk, bighorn sheep, black bear, grizzly bear, mountain goat, timber wolf, cougar and woodland caribou (Banfield 1974; Soper 1964). Numerous smaller mammals also occur. Migratory birds do not seem to be especially common, perhaps due in part to the scarcity of lakes. Fish are generally plentiful in the lakes, rivers and creeks.

Considering the northern setting and mountainous environment, the climate of the area is more moderate than one might expect. Temperatures are rarely excessive in either summer or winter, and precipitation - particularly in the form of snow - is moderate.

ARCHAEOLOGICAL INVESTIGATIONS

Three major projects form the basis of our archaeological knowledge of the Grande Cache region of the northern Rockies: excavation of a site on the shore of Grande Cache Lake, excavation of a site in the Smoky River valley, and site survey along these two and other nearby water bodies. Chronologically, the first study was the Smoky River excavation at GaQs-1, the Smoky site, during the 1974 and 1975 seasons. The Smoky site had been discovered five years earlier by Rob Bonnichsen and Jack Elliott while on a hunting trip in the Grande Cache area. Walking along a point bar on a terrace edge some 20 m above river level, they recovered several flaked tools, including a complete projectile point described by Bonnichsen as a Clovis point. It was the chance of recovering in situ

Clovis material that led to our excavations in 1974 and 1975. These excavations were directed by the senior author while a graduate student at the University of Alberta and were funded by a grant from the Boreal Institute and through summer funding and equipment supplied by the Department of Anthropology.

Work was resumed in the northern Rockies in 1978 when, as a staff archaeologist at the Archaeological Survey of Alberta, the senior author identified this area as one which warranted additional research attention. A two-year research project, which called for one season of site survey and a season of excavation, was initiated. In 1978, archaeological reconnaissance of the shoreline of Grande Cache Lake, a 15 km portion of the Sulphur River valley and selected localities on the Smoky River were completed. In 1979, one of the sites discovered on Grande Cache Lake was excavated, and some additional survey was completed on the Smoky River and at Ptarmigan Lake. To date, only brief reports of these studies have been presented (Brink 1974, 1975, 1979a, 1980); the results are discussed below.

ARCHAEOLOGICAL SURVEY

Most of the areas examined for archaeological sites were within 150 m of a water source. All areas surveyed were examined in judgmental fashion, the objective being to find and test as many sites as possible within the survey area. Thus, we looked for sites where experience had taught us they were likely to occur, but as a check we also occasionally searched areas where we would have predicted a low site potential. Although not systematic, our search was exhaustive in that the poor visibility of sub-surface deposits required continuous employment of shovel test holes.

All surveyed areas were recorded on 1:50,000 topographic maps. All shovel tests associated with a proven site were mapped with compass and chain on simple sketch maps. All shovel tests were circular pits measuring about 50 cm in diameter. No matrix was screened. Given the sparse soil deposition over most of the region, most pits were dug to depths of 30-40 cm, at which point sterile glacial deposits were usually encountered.

When flaked stone, fire-broken rock or bone was recovered from a test hole, the find area was always tested further with a minimum of four additional test holes. Usually these were placed between 5-10 m from the original find and were arranged in such a way as to test in different directions from the original find. Shovel testing of all sites radiated out from the original find until one or more tests in a particular direction proved negative. All excavated artifacts were retained except for fire-broken rock which was counted and discarded. When test holes encountered dense deposits of ash, charcoal and bone, suggesting the presence of a feature, digging was terminated.

RESULTS

A total of 36 prehistoric and five historic sites were recorded. Our survey of Grande Cache Lake resulted in the identification of fourteen sites, all prehistoric. The 15 km Sulphur River survey produced seventeen prehistoric sites, one of which also contained a historic component. The survey of Ptarmigan Lake resulted in the recording of two historic sites. Finally, sporadic survey along the Smoky River resulted in the recording of five prehistoric and three historic sites (Figure 64). A summary description of all recorded sites is presented in Table 13. The results from our survey of these different areas are briefly presented below.

Sulphur River

Along the Sulphur River, all sites were recorded on the highest terrace, which is the one main, continuous terrace in the survey area (Figure 65). This terrace lies about 75 m above the river level and generally follows a 1005 m A.S.L. contour. All lower terraces, where they exist, were traversed and shovel tested and, even though these terraces ranged from 2-50 m above the current water level, no historic or prehistoric sites were recorded.

The Sulphur River, in general, is a deeply incised, steep-sided river system with a confined channel. Access across the river ranges from very difficult to impossible (Figure 66). The topography of the river likely

Table 13. Summary of prehistoric and historic sites from the Grande Cache region.

BORDEN NUMBER	SITE TYPE		LOCATION			MATERIALS			
	Prehistoric	Historic	River	Lake	Inland	Lithics	Fauna	FBR	Historic
FjQv-1		X		X					X
FjQv-2		X		X					X
FkQt-1		X	X						X
FkQu-1	X		X			X			
FkQu-2	X		X			X			
FkQu-3		X	X						X
FkQu-4	X		X			X			
FkQu-5		X	X						X
F1Qs-2	X		X			X			
F1Qs-3	X		X			X			
F1Qs-4	X		X			X			
F1Qs-5	X		X			X			
F1Qs-6	X		X			X			
F1Qs-7	X		X			X		X	
F1Qs-8	X		X			X			
F1Qs-9	X	X	X			X			X
F1Qs-10	X		X			X			
F1Qs-11	X		X			X		X	
F1Qs-12	X		X			X		X	
F1Qs-13	X		X			X		X	
F1Qs-14	X		X			X	X	X	
F1Qs-15	X	X				X	X		X
F1Qs-16	X		X			X	X		
F1Qs-17	X		X			X	X		
F1Qs-18	X				X	X			
F1Qs-19	X			X		X			

Table 13 continued

BORDEN NUMBER	SITE TYPE		LOCATION			MATERIALS			
	Prehistoric	Historic	River	Lake	Inland	Lithics	Fauna	FBR	Historic
FlQs-20	X			X		X	X	X	
FlQs-21	X			X		X		X	
FlQs-22	X			X		X		X	
FlQs-23	X			X		X		X	
FlQs-24	X			X		X	X	X	
FlQs-25	X			X		X		X	
FlQs-26	X			X		X	X	X	
FlQs-27	X			X		X	X	X	
FlQs-28	X			X		X			
FlQs-29	X			X		X			
FlQs-30	X			X		X	X	X	
FlQs-31	X			X		X	X	X	
FlQs-32	X			X		X			
FlQt-1	X		X			X			
FlQt-2	X		X			X			
FlQt-3	X		X			X			
FlQt-4	X		X			X	X	X	
GaQs-1	X		X			X			

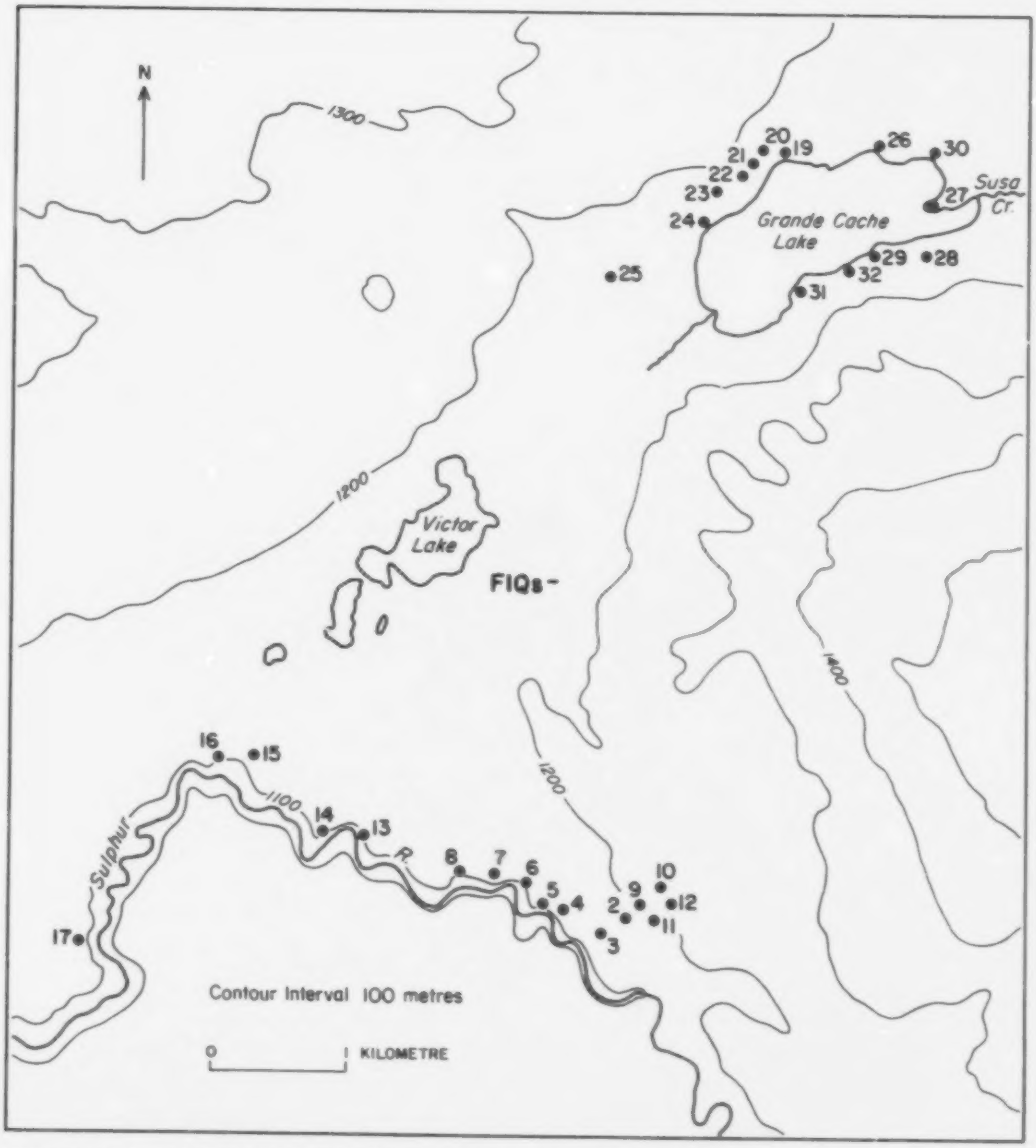

N
1300
1200
1200
1100
1400
Grande Cache Lake
Victor Lake
Susa Cr.
Sulphur R.
FIQs-
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
19
20
21
22
23
24
25
26
27
28
29
30
31
32
Contour Interval 100 metres
0
1 KILOMETRE

Figure 65. Location of sites found during the Grande Cache Lake and Sulphur River surveys.

played an influential role in determining prehistoric settlement and can account for the restriction of sites to the highest terrace only.

As measured by the number and distribution of productive test pits, sites discovered on the Sulphur River were characterized by their small site. At many of these sites, one or two shovel tests were productive while additional tests placed around these finds proved negative. We

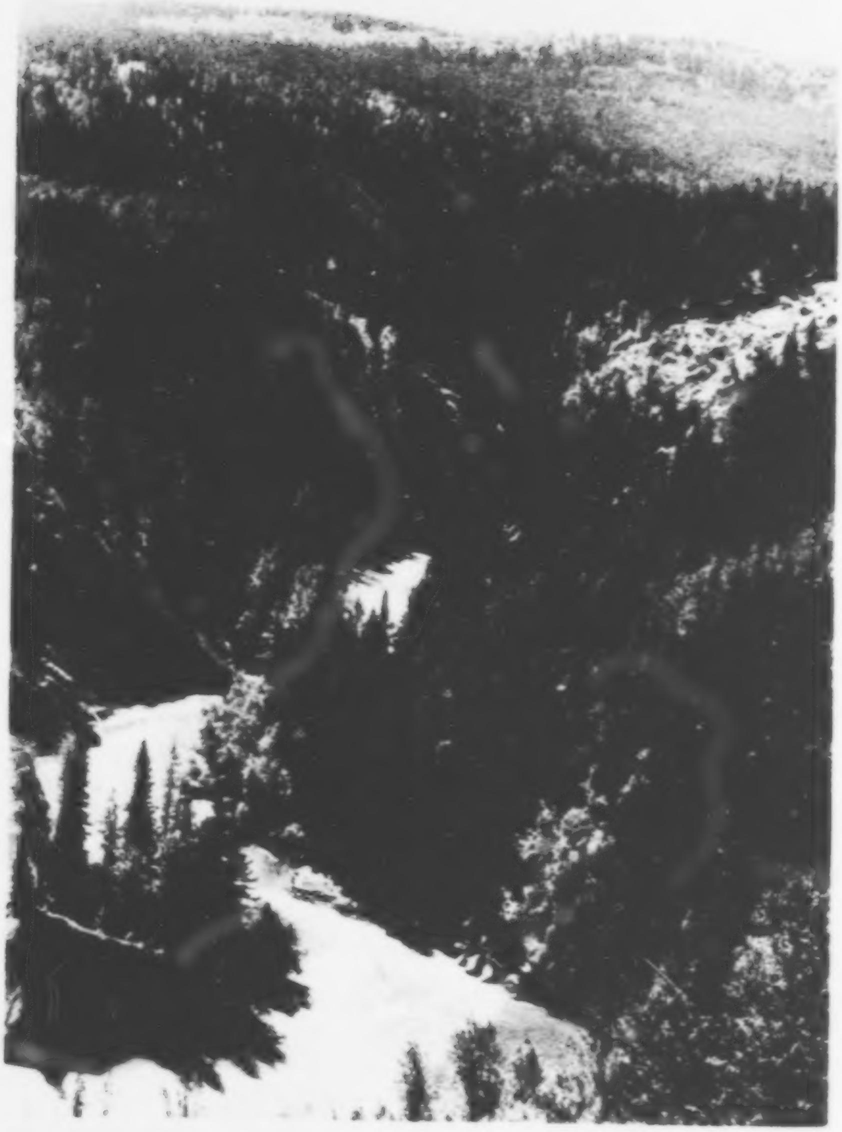


Figure 66. The Sulphur River.

postulate that sites along the high Sulphur River terrace are largely transient campsites or brief stopping points where minor tool chipping was conducted and occasional meals were prepared. Their position along the rim of the river valley reflects the use of this level and accessible route as a means of travel between the Smoky River and places to the south and west. It is doubtful that the placement of the sites on the valley rim was due to the proximity of the Sulphur River since the water body itself is largely inaccessible in some areas. Rather, the river valley edge represents the route most clear of vegetation and hence the easiest travel corridor through the region.

Items of flaked stone were recovered at all seventeen sites found along the Sulphur River. In addition, five sites (FlQs-5, 14-17) contained some bone, and seven sites contained some fire-broken rock (FlQs-5, 11-15, 17). In total, 235 lithic items were recovered from 218 test holes dug at these seventeen sites. Approximately twenty pieces of fire-broken rock and about 260 very small bone fragments were recorded.

Grande Cache Lake

Prehistoric sites located on Grande Cache Lake were decidedly similar to those situated on the Sulphur River in that, for the most part, they were small and characterized by a very low level of archaeological visibility. A total of fourteen prehistoric sites were recorded on the lakeshore; the great majority lie along the north and northeast shoreline (Figure 65). This pattern fits with other surveys along east-west flowing rivers and creeks in the Alberta Rockies and boreal forest (Bryan 1975; Magne 1986; Ronaghan, this volume) where the south-facing shore (north side) invariably contains the majority of prehistoric sites. Presumably, the preferential aspect of these sites is the explanation for this phenomenon.

Most Grande Cache Lake sites were undisturbed except near the west end of the lake where the existing highway has destroyed parts of FlQs-19, 20 and 24. The Grande Cache Lake shore, unlike the continuous level terrace of the Sulphur River, is undulating. Although most sites are located in higher areas, we did recover artifacts from test holes dug in very swampy areas along the north side of the lake (e.g., at FlQs-26). Another interesting discovery was the presence of prehistoric sites on very small, localized benches which backed up a hillside to the northwest edge of the lake. Minor breaks in slope, some measuring only a few metres wide and several tens of metres long, were found to contain small amounts of lithics and bone (e.g., FlQs-20-23). These sites are peculiar in that they are well removed from the immediate lakeshore and are indicative of sites easily missed when surveying only the immediate water margins. Currently, there is no explanation for these sites positioned on small benches away from the lake.

The major difference between the results of the Sulphur River and Grande Cache Lake surveys is that, in the case of the former, all sites were exceedingly small in extent and low in artifact frequency, while in the case of the latter a few sites deviated from this pattern. Of the fourteen sites on the lake, one could be considered a large and productive site (FlQs-30). Two more sites (FlQs-27, 31) could be considered of moderate size and artifact yield. The remaining eleven sites are similar in most respects to those recorded on the Sulphur River. These sites straddle the threshold of archaeological visibility; that is, shovel tests yielded such small amounts of cultural material that it would probably be difficult to attempt to relocate some of the sites by returning to the appropriate area and digging more shovel tests. The figures presented below do not include excavation results from the one large site, FlQs-30. This site was subsequently excavated and is reported on separately below.

All sites on the lake were characterized by flaked stone artifacts. A total of 294 items were recovered from 233 test holes dug at the thirteen sites. The great majority (over 95%) of these items are flakes and shatter. Fire-broken rock was recovered from ten of the sites (FlQs-19-27, 31), and faunal remains were recovered from six sites (FlQs-19, 20, 24, 26, 27, 31). A total of 45 pieces of fire-broken rock and 1053 pieces of bone were recovered. Again, the bone was recovered in highly fragmented condition.

Ptarmigan Lake

Our survey of the lands surrounding Grande Cache Lake had indicated that a high density of sites would be associated with lakeshore terraces. Accordingly, it was decided to conduct a quick survey of another lake in the Grande Cache region. We examined all of the east shore, the south end and the west shore of Ptarmigan Lake (Figure 64). Our results were disappointing, since no prehistoric sites were recorded. Two recent historic sites were observed and recorded (FjQv-1 and 2). Both are campsites from occupations which probably date to within the last fifty years and consist of fireplaces, refuse (especially cans and bottles), cut wood, evidence of tent spots, as well as brush lean-tos and activity areas such as wood chopping.

The lack of prehistoric sites in the area surveyed can probably be attributed to the fact that much of the lakeshore area was poorly suited for habitation. The topography around much of the lake was either low and boggy or sloping uphill at moderately steep angles. As well, the lake is probably frozen for seven or eight months of the year. The shallow water may enable freezing to reach the bottom of the lake, thereby killing any fish. The ground vegetation around the lakeshore is a hummocky, tussock bunch grass and moss that makes walking difficult and would likely be unpleasant to camp on. Finally, the lake is situated in a remote, dead-end tributary valley to the Jackpine River valley. Travel through here for any reason except to get to this lake would seem unlikely.

Smoky River

Selected spots along the Smoky River were examined. Mainly these included prime valley areas downstream from Grande Cache previously disturbed by the Alberta Resources Railway, the road leading to the Smoky River Coal plant, and the plant itself. Upstream from Grande Cache, where access is difficult, attempts to use boats as a means of transport failed. Hence, our survey of the Smoky was sporadic.

Most of these surveys were largely unproductive. No sites were recorded downstream between the Grande Cache bridge and the Smoky River Coal plant. Terrace development in this area is poor, and those terraces that do exist have been largely destroyed by the coal road or railroad. In contrast, a high, level, well-drained, south-facing terrace begins just upstream from the bridge and continues at least 5 km to the Smoky/Sulphur confluence. We walked and tested this entire terrace area but only identified two small prehistoric sites (FlQt-3 and 4). Similar results were obtained from our examination of the Smoky/Muddywater confluence area; two prehistoric sites (FkQu-1 and 2) and two historic sites (FkQu-3 and 5) were recorded (Figure 64). The prehistoric sites were all characterized by small amounts of artifact material and a limited spatial extent. The historic sites consisted of abandoned trappers' cabins and several caches. A single, small prehistoric site

(FkQu-4) was also recorded on the north bank off the Smoky, about 1 km upstream from the confluence with the Jackpine River.

SUMMARY OF ARCHAEOLOGICAL SURVEY

Site Size

Site size was calculated for 32 prehistoric sites, using productive test pit distribution and recognizing that a tightly clustered, localized distribution of cultural material would elude detection by many, if not all, sub-surface testing techniques. Estimates ranged from 15 to 3532 square metres; However, the great majority of sites fall into smaller size classes. Fully 70 percent of the sites are smaller than 600 square metres. The four sites which make up the greater than 1200 square metre size class are all situated on Grande Cache Lake and tend to be long, linear sites paralleling the lakeshore.

Flaked Stone

All sites contained chipped stone items. The number of lithics recovered from each site ranged from a low of one to a high of 120, with a mean of 18.3. Lithics were classified into the categories of debitage, formed tools, retouched/utilized flakes, core/core fragments and other. Debitage, consisting of flakes which are short, narrow, thin and usually lack cortex, dominate the assemblages. These attributes, considered together with the remainder of the tool kit, are consistent with the expected output of the final stages of tool manufacture, and especially tool repair and resharpening.

Several specimens have been identified as microblades. One nearly complete obsidian specimen (Figure 67) was recovered from FlQs-27, on the long, thin point of land projecting into the east end of Grande Cache Lake. The dorsal face has four longitudinally oriented distally trending flake scars which form three approximately parallel dorsal ridges. The resultant cross section is thin and trapezoidal. It is 0.08 g in weight, 13.3 mm long, 5.5 mm wide, and 1.1 mm thick. The platform is a thin single flat surface. Platform preparation is present as numerous minute step terminated flake scars adjacent to the platform on the dorsal face. On the ventral face, a small salient bulb of force flattens out to give

Figure 67. Obsidian microblade fragment recovered from FlQs-27.

the longitudinal section a concavo-convex shape. The physical attributes of this specimen apparently differ from those used to establish the interior British Columbia microblade tradition (D. Sanger, personal communication). The obsidian has been sourced as coming from the Anahim Peak quarries of southwestern British Columbia, some 800 km southwest of the site. Other pieces of obsidian recovered from sites in the Grande Cache region also came from Anahim Peak. Trade, travel or contact with this distant area is thus well established. Pending further analysis, little can be said about these northern microblades at this time. No microblade cores or fragments thereof were recovered.

Projectile points were generally scarce from tested sites (n=4). A basal fragment was recovered from FlQs-23, one of the several sites situated on the small benches away from the lakeshore. This mottled chert specimen (Figure 68e) has a straight base and very shallow notches.

An intriguing bifacially flaked specimen was recovered from FlQs-27 on Grande Cache Lake (Figure 68a). This rich, black chert specimen appears to be the base of a projectile point, possibly an early variety such as Agate Basin, the stem of an Alberta or Scottsbluff point. The base is straight and has been thinned on both sides. The blade edges are also straight and exhibit fine parallel pressure flake scars.

Another point fragment recovered from FlQs-31 (Figure 68d), represents only a portion of a base which has been snapped both longitudinally and transversely. The specimen is made of gray chert, has a straight base, a small parabolic notch and is well ground along the base and inside the notch. From the same site, a complete black chert biface (Figure 68h) was also recovered. The dull tip, asymetrical edges and longitudinal curvature of the specimen argue against it being a projectile point. A hafted knife seems a more likely function.

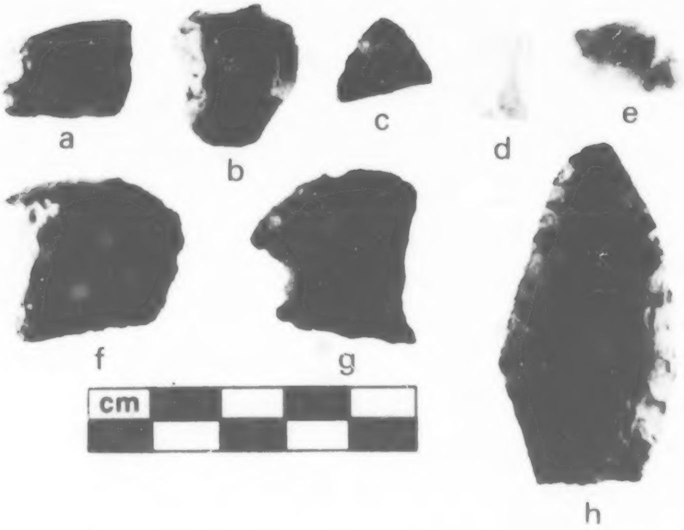


Figure 68. Artifacts from Grande Cache Lake survey sites. Projectile points: a, b, d; bifaces: c, h; endscrapers: b, f, g.

Other tools and cores recovered from various sites are illustrated in Figures 68 and 69. Four cores were recovered (Figure 69b). Two are "Glacier Pass" silicified mudstone (Figure 69c and d), one is a fine quality black chert (Figure 69a), and the other is a fine quartzite. Seven unifaces were recovered (Figure 68b, f and g). Three are made of quartzite, and four of black chert. In addition to the specimen in Figure 68, four other bifaces were recovered. One is made of quartzite, two of chert and one of silicified sandstone.

Faunal Material

A total of 1,317 bone fragments, weighing 288 g, were recovered from eleven sites. The largest sample (omitting FlQs-30) consisted of 712 pieces from FlQs-27 on Grande Cache Lake. In all cases, the bone was extremely small, suggesting extensive chemical and mechanical breakdown in the acidic soil or considerable cultural processing such as to render bone grease (Leechman 1951). The fact that much of the bone was burned or calcined, and the strong correlation between the presence of bone and fire-broken rock (ten of the eleven sites), suggests that some cultural processing was indeed occurring.

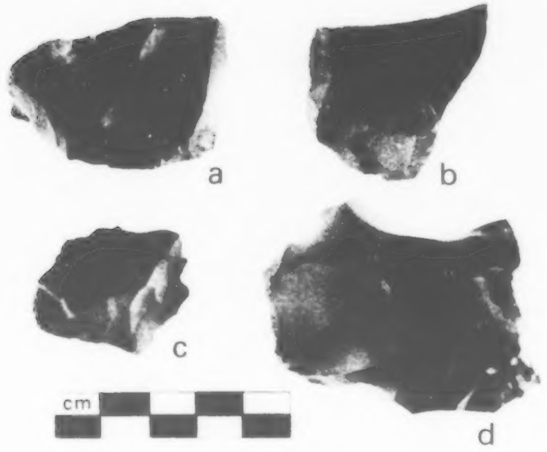


Figure 69. Cores from Grande Cache survey sites.

Obviously, such fragmentation seriously inhibits species identifications. Large mammal bones positively identified include moose (Alces alces), bear (probably Ursus americanus) and elk (Cervus canadensis), all from FlQs-27. Bones, tentatively identified as being from a medium-sized mammal (i.e., deer or sheep), were recovered from FlQs-16, 26, and 31. Small mammal bones (i.e., lynx, otter) were recovered from two sites, FlQs-27 and 31. Bones of a hare (Lepus americanus) were also recovered from FlQs-31. No fish or birds were identified.

Fire-broken Rock

Fire-broken rock, all of local quartzite cobbles, was recovered from a total of seventeen sites: ten on the lakeshore, and seven on the rivers. Quantities of fire-broken rock were never large, which is expected given the small sub-surface view a shovel test provides. All but one site (FlQs-31) produced less than ten pieces. No discrete features were recognized during our shovel tests, although one pit at FlQs-27 was terminated because of a high yield of calcined bone fragments, as well as a few fire-broken rocks, suggestive of a feature.

Dating

Most sites discovered during the survey project could not be radiometrically dated. Charcoal was seldom encountered in any test pits, or, if some was observed, it was often unclear whether the carbon was of cultural origin. Bone occurred at a fair number of sites but typically only in tiny amounts. Only two sites provided dateable material: FlQs-30, which was subsequently excavated and yielded numerous dates (discussed later), and FlQs-27, which yielded a date of 1845 ± 50 years B.P. (S-1587). This latter date was obtained from an amalgamation of hundreds of very small burned and unburned bone fragments collected from a test pit.

Discussion

In reviewing the site settings, the results of the lithic analysis and the condition of the bone, it would appear that these sites in the Grande Cache region can best be described as transitory camps, occupied by small numbers of people for short periods of time. Many of the sites could have been created by one or two individuals pausing for a few hours to sharpen some tools and perhaps have a meal. The low amounts of material in these sites plus the general similarity of the size and types of raw materials present further suggest that many of these sites were occupied only once. This may be understood by realizing that many of the site locations, especially those along the river terraces, are nearly indistinguishable from one another; that is, all offer south-facing, level, well-drained occupation areas. Exceptional spots occur on elevated, level benches on the north shore of lakes (e.g., FlQs-30) and on point bars at the confluence of some of the major rivers (e.g., GaQs-1).

It is also worth noting that although the homogeneity of the recorded sites as small transitory camps has been stressed, there were still noteworthy differences between the sites on the river valleys versus those recorded on Grande Cache Lake. First, all the river valley sites were small in size and low in material, while three lakeshore sites (FlQs-30, 31, 27) were of substantial size and yielded relatively large amounts of cultural material. Second, sites on the lakeshore tended to contain more bone (43% vs. 23%) and fire-broken rock (71% vs. 32%) when compared with the river sites. This presumably reflects a greater incidence of prolonged camping at some of the lakeshore sites, at least of sufficient time to consume some food and construct and utilize some site features. The elevational proximity to water exhibited in the lake-side sites suggest a stronger likelihood of resource utilization rather than simple through travel as suggested at the high terrace river sites. Finally, the lake sites tend to be somewhat more productive than river terrace sites, reflected by the fact that 47 percent of all shovel tests at lake sites yielded artifacts compared with 31 percent for river terrace sites.

ARCHAEOLOGICAL EXCAVATIONS

FlQs-30: THE GRANDE CACHE LAKE SITE

Site Setting

The Grande Cache Lake site is situated on a roughly level bench or terrace at the northeast end of the lake (Figure 70). This bench currently lies 4-5 m above the water level at the point where our excavations were conducted. The site covers an area of some 13,000 square metres, primarily in an east-west direction, occupying a band of level ground from the edge of the terrace back some 30 m and extending over a linear distance of about 500 m. Site boundaries were determined in 1978 when the area was tested with 65 shovel tests. A single block excavation of twelve contiguous 2x2 m units totalling 64 square metres was completed in 1979 at the most productive, western end of the site (Figure 71).

Most of the site area today is covered with fairly heavy thickets of trembling aspen and white spruce, within which ground cover is dominated by moss and sparse grass. In small, scattered openings shrub and herb cover is extensive and includes Canadian buffalo-berry, blueberry, prickly rose, bearberry, and various grasses and asters.

Soils at the site are Podzolic, with a thin (c. 5 cm) Ah horizon, a 15-25 cm thick Bf horizon representing the silty, reddish-brown loess cover, and a basal deposit of calcareous silts and gravels (Cca horizon)

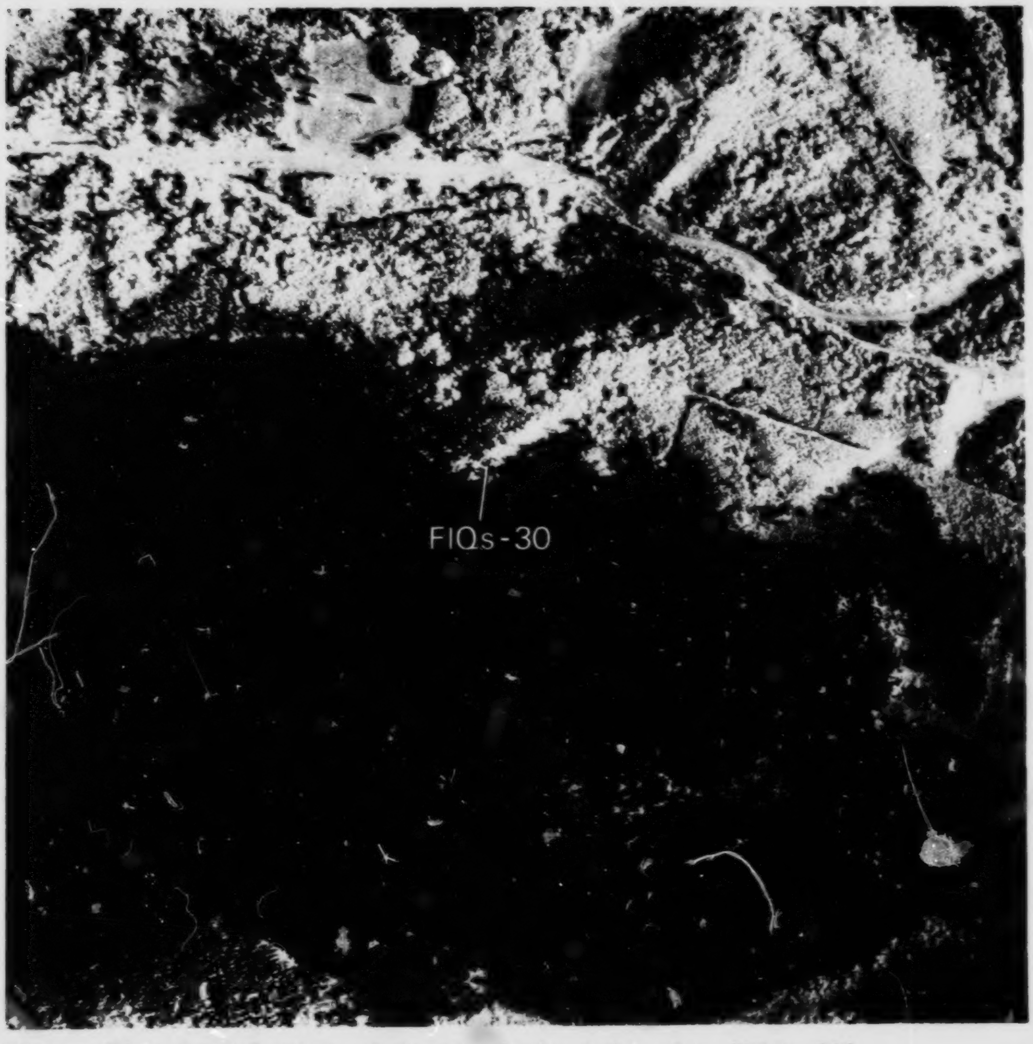


Figure 70. Aerial view of Grande Cache Lake site (FlQs-30).

being glacial outwash materials. Soil pH, measured in the Bf horizon, was 4.5.

Excavation Methodology

A grid system was established and units laid out as illustrated in Figure 71. Knowing the shallowness of the artifact bearing deposits, it was initially decided to excavate in arbitrary 5 cm levels. However, this practice was soon abandoned in favour of 10 cm levels as it became apparent that the density of materials was such that progress would be much too slow using the smaller increments. All units went through two 10 cm levels, and a few began a third level before clearly sterile

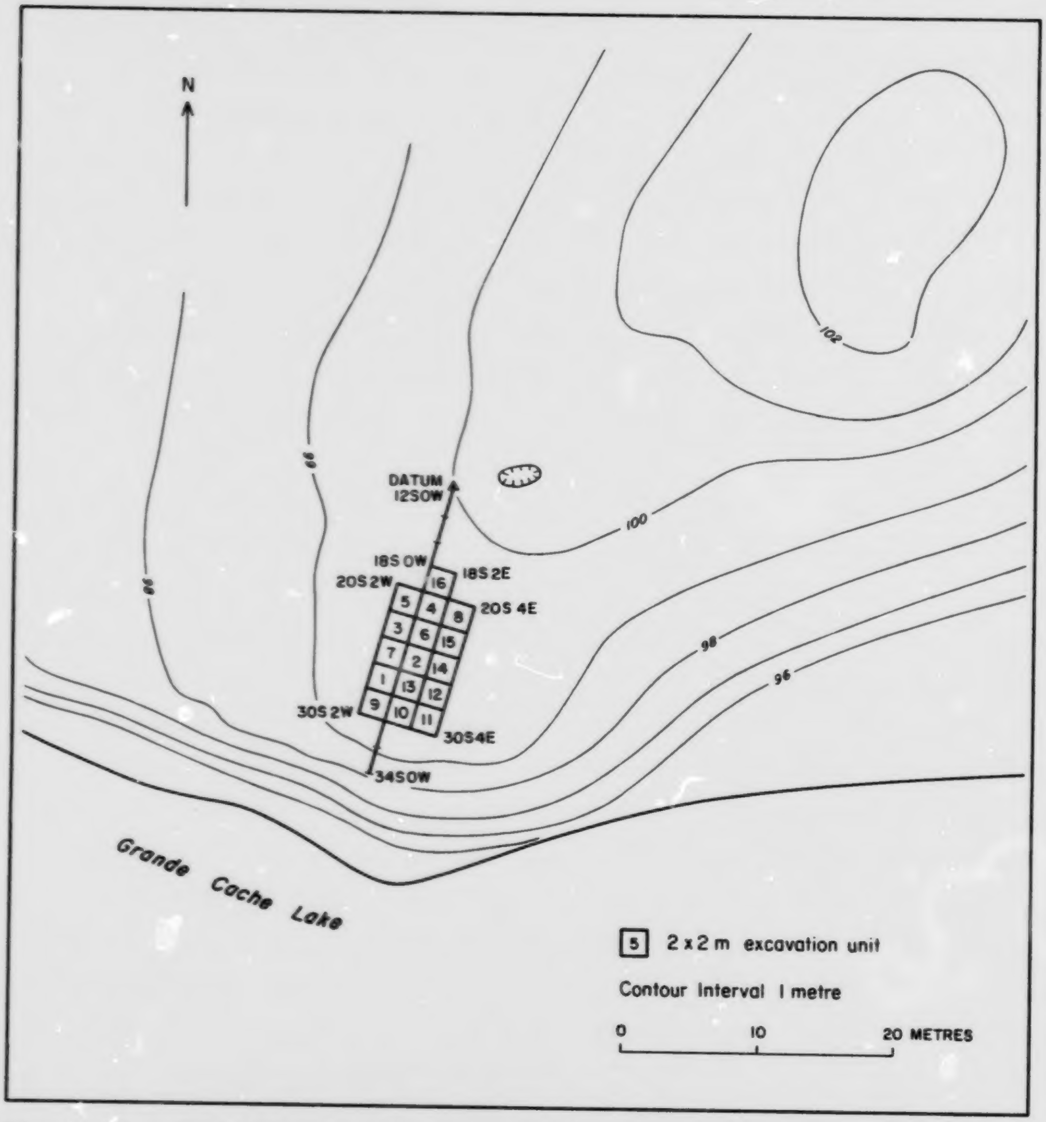

N
102
100
99
99
98
96
DATUM
12SOW
18S OW
18S 2E
20S 2W
20S 4E
16
5
4
8
3
6
15
7
2
14
1
13
12
9
10
11
30S 2W
30S4E
34SOW
Grande Cache Lake
5 2 x 2 m excavation unit
Contour Interval 1 metre
0
10
20 METRES

Figure 71. Grande Cache Lake site: map of excavation area showing excavation unit designations.

deposits were encountered. Recording of horizontal provenience attempted to maximize information return yet minimize energy and time expended. Piece plotting of artifacts was deemed advisable since it was apparent that vertical stratigraphy would likely be lacking and horizontal provenience would likely play a more important role in site interpretation. Floor plan maps of each 1 square m unit were used as a means of recording artifact placement, but artifacts were bagged in bulk from each 1 m square. Thus, maps exist which plot the distribution of all lithics, bone and fire-broken rock over the 64 square m area. However, with the exception of formed tools, individual items cannot be identified with the specific points on the maps.

The bench on which the site is situated is believed to be composed of silts, sands and gravels laid down during glacial ablation, probably some 12-13,000 years ago. Holocene deposition has been essentially limited to loess blown down the Grande Cache Valley from the flood plains of the Smoky River and formed through decomposition of on-site organics. In all, this has produced a cap some 25 cm thick over the parent glacial material.

The sole artifact bearing horizon, the Bf loess deposit, displayed no internal structure. Within the 15-20 cm thick silt deposit there was no evidence of any stratification. The deepest artifacts in the Bf horizon, near the contact with the glacial materials, were assumed to represent the earliest occupation at the site, while artifacts at the top of the loess should be the most recent. No apparent vertical layering of artifacts was noted during excavation of the Bf horizon, and we eventually concluded that it was not possible to meaningfully isolate artifacts separated by only 15 cm. The arbitrary excavation levels obviously crosscut temporally and spatially related artifacts and probably grouped assemblages that were originally laid down separately. This problem of compressed stratigraphy at repeatedly occupied sites is probably the single greatest hindrance to site interpretation in Eastern Slopes archaeology. As a result, there is no meaningful way to separate parts of the faunal or lithic assemblage for analysis and comparison to other parts of the total site sample. These problems led to an amalgamation of the excavated data without reference to vertical provenience. This unfortunate treatment of the data can only be obviated when some well-stratified sites (or demonstrable single component sites) are excavated.

Dating

A total of six radiocarbon dates were obtained (Table 14): three from charcoal samples, and three from bone samples. Since no single large bones were recovered, the bone dates were obtained by combining

Table 14. FlQs-30 radiocarbon dates.

Sample #	Material	Prov.	Date
1	bone	Level 1, Unit 3	380 ± 305 years B.P. (S-1890)
2	charcoal	Level 2, Unit 9	1770 ± 170 years B.P. (S-1886)
3	bone	Level 2, Unit 6	2040 ± 700 years B.P. (S-1891)
4	charcoal	Level 3, Unit 2	2880 ± 280 years B.P. (S-1887)
5	charcoal	Level 3, Unit 6	4605 ± 75 years B.P. (S-1888)
6	bone	Level 3, Units 2,4,12	5635 ± 2180 years B.P. (S-1889)

small fragments from one level and usually from a single 1x1 m unit or in one case three contiguous units. All bone dates are collagen dates. Charcoal was rare at the site, and only two feature stains yielded enough charcoal to obtain dates. The third charcoal date (sample #3) was from a sample of diffuse charcoal.

It is encouraging to note that the dates are essentially in stratigraphic order, although several dates have wide standard deviations thus reducing the confidence of this order. It should also be noted that assigning dates to 10 cm levels can be misleading; that is, all level 3 dates can be said to have come from materials recovered between 20-25 cm, since virtually nowhere on the site did we excavate to a depth of 30 cm.

The first date must be discarded because it is essentially modern. It may well have been contaminated by surface charcoal or sub-surface buried roots or rootlets mixing with the sample. The last date is also discarded, since the great standard deviation renders it of little utility in establishing an age of the dated materials. It probably suffered from an insufficient sample size (43.5 g of calcined bone). The second date for level 2 with a standard deviation of 700 years is also of little value.

In general, it can be assumed that the site was occupied on numerous occasions between about 5,000 years ago and sometime in the later prehistoric period. It would appear that occupation was fairly intensive, or repetitive, between approximately 5,000 and 1500 years ago, although important later occupations cannot be ruled out until more dates are obtained from level 1 organics. The occurrence of points which resemble those of the McKean complex is consistent with this suggestion.

Nothing in the artifact assemblage conflicts with these dates; that is, no point styles were recovered which are indicative of types known to pre-date 5,000 years B.P. or to post-date 1500 years B.P. The date from FlQs-27 (1845 years B.P.) further supports the case for intensive occupation during circa 5,000-1500 years B.P. along the Grande Cache Lake.

Results

A full-time crew of five excavated sixteen 2x2 m units in two months. Artifacts were first encountered just under the leaf litter and sod, usually at a depth of 5 cm. Only a few historic items, such as gun shell casings and bottle glass, were recorded from the sod level. Prehistoric materials first appeared at the contact between the sod and the aeolian silts and continued uninterrupted throughout the loess level. In most places, the loess did not extend below 20 cm below ground surface; however, occasional deeper pockets (c. 25 cm) were encountered where local topographic depressions existed. In general, all artifacts were compressed into a 15 cm thick horizon.

A total of 4,406 flaked stone items were recovered. The following categories were established: projectile points, bifaces, unifaces, retouched/utilized flakes, cores, bipolar pebble cores, complete flakes, shatter and miscellaneous artifacts (Table 15).

Debitage

Fully 93 percent of the assemblage is classified as debitage (flakes and shatter). A total of fifteen different material types were recognized in the collection, although many of these are represented by very few specimens (Table 16). The dominant materials used at FlQs-30 were various types of quartzite (34%), cherts (22.1%) and silicified mud and siltstone (32.6%), which together account for 88.7 percent of the entire debitage sample. Because of the relatively poor flaking properties of quartzite, and in the absence of evidence that this material had been intentionally transported, it is assumed that the quartzites used at the site were locally obtained. This is supported by examination of factors such as the size, weight and amount of cortex of the quartzite pieces. Quartzite cobbles can currently be obtained from the edge of the lakeshore.

Table 15. Summary of lithics from FlQs-30.

Category	No.	% of Assemblage
Projectile points	8	0.2
Projectile points fragments	21	0.5
Bifaces	11	0.2
Biface fragments	23	0.5
Unifaces	26	0.6
Uniface fragments	4	0.1
Retouched/utilized flakes	145	3.3
Cores	16	0.4
Bipolar pebble cores	40	1.0
Flakes	555	12.6
Shatter	3548	80.5
Misc. artifacts	9	0.2
Total	4406	100.1%

Likewise, cherts occur in the glacial till and outwash gravels which blanket the area; however, these invariably consist of small pebbles. No outcrops of chert are known for the region. Locally available chert pebbles occur in a range of colours, but most are black, blue to bluish gray and white. They are virtually the sole source for the bipolar core industry, as well as for many small tools found at the site. No chert pebble cores have been seen to exceed about 5 cm in length, thus imposing severe limitations on the size of artifact which can be produced. Large chert tools do occur in small numbers at the site; the source of these materials is unknown, although some are believed to originate in the Peace River area.

The precise source of the silicified silt and mudstones is, for the most part, unknown, although all are believed to be relatively local. One particular type of silicified mudstone (Figure 69c and d) has been sourced to the quarry/workshop sites on the upper reaches of the Snake Indian River in northern Jasper National Park (Anderson and Reeves 1975). These authors refer to this material as "Glacier Pass" silicified mudstone and postulate that, because of the general paucity of this material in the sites discovered along the Athabasca River, the primary use of the material may be oriented to the north in the Smoky River drainage system (Anderson and Reeves 1975:101-103). This material - a

Table 16. Count and weight of flakes and shatter by material type: FlQs-30.

Material Type	Flakes		Shatter		Total	
	No. (%)	Wt. (%)	No. (%)	Wt. (%)	No.	%
Quartzite (1)	171 (30.8)	2149 (86)	1054 (29.7)	4325.2(73)	1225	29.8
Vitreous Quartzite(2)	23 (4.1)	18 (0.7)	151 (4.2)	116.8(1.9)	174	4.2
Quartz (3)	1 (0.2)	0.1 (0.0)	7 (0.2)	3.1(0.0)	8	0.2
Chert (4)	95 (17.1)	48.6 (1.9)	810 (22.8)	524.4(8.8)	905	22.1
Jasper (5)	3 (0.5)	14.9 (0.6)	15 (0.4)	18.6(0.3)	18	0.4
Silicified mudstone (6)	64 (11.5)	24 (1.0)	230 (6.5)	216.5(3.7)	294	7.2
Silicified siltstone(7)	144 (26)	40.8 (1.6)	899 (25.3)	244.8(4.1)	1043	25.4
Obsidian (8)	3 (0.5)	0.3 (0.0)	39 (1.1)	5.6(0.1)	42	1.0
Ignimbrite (9)			14 (C.4)	16.8(0.3)	14	0.3
Chalcedony (10)	7 (1.3	7.6 (0.3)	9 (0.2)	2.7(0.0)	16	0.4
Non-silicified mudstone/siltstone(11)	10 (1.9)	89 (3.6)	56 (1.6)	98.2(1.7)	66	1.6
Sandstone (12)	2 (0.4)	51.6(2.1)	1 (0.0)	0.9 (0.0)	3	0.1
Argillite (13)	1 (0.2)	2 (0.1)	9 (0.2)	2.4 (0.0)	10	0.2
Silicified Sandstone(15)	27 (4.9)	45.1(1.8)	236 (6.6)	341.3 (5.8)	263	6.4
Silicified Limestone(16)	4 (0.7)	6.6 (0.3)	18 (0.5)	9.9 (0.2)	22	0.5
Total	555(100.1)	2497.6(100)	3548(99.7)	5927.2(99.9)	4103	99.8

brown to yellowish brown, fine-grained silicified mudstone - does occur at FlQs-30, although perhaps not in the amounts one might expect given the arguments of Anderson and Reeves. Within the debitage sample, 294 items representing 7.2 percent of the assemblage are identified as Glacier Pass material.

Given the prominence of sandstones, siltstones and mudstones in the lithology of the local bedrock, it is not surprising that these materials play an important role in the prehistoric tool kits. Unfortunately, research to date has not identified any local bedrock sources, except the Glacier Pass material. Furthermore, no sites yet identified display a lithic assemblage suggestive of close proximity to a quarry source. Local till and river gravels probably contain representatives of all major rock types in the area, but it is uncertain whether desirable materials occur in sufficient quantities to warrant collection from these sources.

One type of silicified siltstone can be sourced and occurs in fractional amounts in the FlQs-30 assemblage. This is a brown and black banded silicified siltstone which occurs in outcrops in the Banff-Kananaskis region and has been called "Banff Chert" (Aresco 1977; Brink 1979b). One bifacial tool at FlQs-30 (Figure 76i) was made from this material; two tiny retouch flakes are identified as probably the same material. Thus, there is evidence, albeit minimal, for trade or contact with southern parts of the Alberta Rockies.

Forty-two pieces of obsidian were recovered, mostly small shatter (Table 16). None were subjected to source analysis, although a piece from FlQs-27 a few hundred metres away was sourced to Anahim Peak, B.C. This is the same source as obsidian from the Smoky site (GaQs-1), and we would speculate that the FlQs-30 obsidian is also from this source.

Another noteworthy material is quartz crystal of which eight small pieces of debitage were composed. This material looks like clear glass and is struck from large quartz crystals which apparently grow in caves or caverns. Several geologists indicated that the material could be from almost anywhere in the mountains.

Chalcedony occurs in small amounts (16 pieces). The source of most of this material is also unknown, but one finished tool and two very small flakes are made from a chalcedony which exhibits the characteristics of Knife River Flint.

A final raw material worthy of comment is that identified as silicified sandstone. Some 263 pieces of this light to dark gray, lustrous rock were recovered. The material is exceedingly similar to what has been identified as Beaver River Sandstone (Fenton and Ives 1982; Ives and Fenton 1983), which outcrops in the Athabasca River valley, 450 km to the northeast of the Grande Cache area. The debitage from FlQs-30 tends to be a bit darker in colour than material from northern Alberta (Ives, personal communication 1986). At this time, all that can be said is that the two materials are very similar but not necessarily from the same source. Other, more local outcrops of a similar geological formation may occur in the northern Rockies.

Shatter

All shatter specimens were counted, weighed, and material type was noted (Table 16). The pieces were run through a series of size squares measuring from 1 to 12 cm on a side with 1 cm increments (Table 17), and the presence or absence of cortex was noted. By count, 96 percent of all shatter is 3 square cm or less in any dimension, although by weight these sizes only account for 37 percent of the specimens. The size data suggests that most of the shatter material is the by-product of relatively fine levels of lithic manufacture, such as retouching completed tools or finishing pre-formed tools. It appears that a minimal amount of primary core reduction or tool manufacture occurred at the site. This is tempered, however, by recognition of the fact that shatter sizes are not as accurate indicators of technological activity as are complete flakes.

In total, 509 pieces (14.3%) exhibited cortex. By raw material, 93 percent of all pieces with cortex belonged to the four main site materials - quartzite, chert, silicified mud and siltstone. If the presence of cortex is an indication of the availability of a particular material, this would suggest that these materials were obtained locally. The general paucity of shatter with cortex gives further support to the view that primary core reduction was not an important activity at the site.

Table 17. Relative numbers and weights of shatter size categories at FlQs-30.

Size Class (cm^2)	No.	%	Total wt. (g)	Avg. wt. (g)
1	1617	45.6	193	0.1
2	1390	39.2	814	0.6
3	401	11.3	1206	3.0
4	87	2.4	738	8.5
5	23	0.6	542	23.6
6	16	0.4	579	36.2
7	6	0.2	339	56.5
8	1	0.03	42	42.0
9	4	0.1	600	150.0
10	0	0	0	-
11	1	0.03	208	208.0
12	2	0.06	663	331.5

Complete (Platform) Flakes

Platform flakes were examined in more detail than was shatter. A total of eighteen different metric and non-metric variables were initially measured or recorded for each of the 555 platform flakes.

The count, weight and material type patterns established for flakes are similar to those of shatter (Table 16). Quartzites, cherts and silicified mud and siltstones account for 89.5 percent of all analyzable flakes. Also, the ratio between the number of flakes vs. shatter in each material type category is fairly consistent, averaging about six to one in favour of shatter. This correspondence between flakes and shatter suggests that both categories were produced on site from the same technological activities.

The amount of cortex on the dorsal surface of platform flakes was recorded as being either none, 1 to 49 percent, 50 to 99 percent, or total cortex. Results reveal that the great majority (89.6%) of flakes had no cortex. These results again support the contention that lithic activities at the site were dominated by later stages of tool manufacture and use, with little evidence of primary manufacture.

Rather than pass platform flakes through size squares, the metric dimensions of these specimens were individually measured (Table 18). Of 555 flakes measured, a few were long, wide, thick and heavy, but the vast

Table 18. Flake dimensions: Grande Cache Lake site FlQs-30.

	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)
Mean:	4.5	18.0	16.1	3.3
Minimum:	0.1	4.1	3.8	0.6
Maximum:	421.3	118.0	110.4	47.9

majority were just the opposite. These tendencies are also completely in keeping with the size data presented for the shatter, and again suggest a strong emphasis on the later stages of tool manufacture at the site.

The preceding analysis suggests that primary manufacture was not an important activity at the site but indicates little about what lithic activities were occurring. Two variables recorded for the flakes which may shed some light on site activities are the platform type (Table 19) and the number of dorsal scars present (Table 20). Platform types were coded as being cortex, single facet, multiple faceted, cleavage plane or other. Dorsal scars were coded according to the number present: 0, 1, 2, 3, 4, 5 or more, or indeterminate. Examining the number of scars present on the dorsal flake surface should provide some indication of the level of technological reduction of the core from which the flakes were struck. Similarly, the platform type should be indicative of the stage of reduction of the core piece. Together, these may allow some inference as to the tool types which produced the debitage.

Over 88 percent of the flakes possessed either single or multiple faceted platforms, with the latter category accounting for the bulk (320/57.6%) of the specimens. Nearly 90 percent exhibited two or more dorsal scars, with most flakes (30.8%) possessing three dorsal scars followed by five dorsal scars (27.6%). Taken together, these data suggest that most flakes were struck from the edges of existing tools.

Tools

Projectile Points and Point Fragments (n=29)

Projectile point morphology is the primary basis upon which most northern North American archaeologists interpret the relative chronology and cultural relationships of the material culture assemblages they

Table 19. Platform morphology on flakes from FlQs-30.

Platform Type	No.	% of Total
Cortex Surface	44	7.9
Single Facet	171	30.8
Multiple Faceted	320	57.6
Cleavage Plane	16	2.9
Other	4	0.7

Table 20. Dorsal face morphology on flakes from FlQs-30.

No. of Dorsal Scars	No.	% of Total
0	7	1.2
1	25	4.5
2	106	19.1
3	171	30.8
4	65	11.7
5 or more	153	27.6
Indeterminate	28	5.0

analyze. In a region where very little previous knowledge exists, firm statements in these regards must be viewed with a great deal of caution. Nevertheless, where stylistic affinities with types defined previously in other regions were recognized, these are offered in the necessarily brief descriptions provided below. These should be considered tentative and the reader is urged to examine the illustrations for comparative purposes.

FlQs-30-33: The brown silicified mudstone artifact has been used as both the tip and one basal corner exhibit impact fractures (Figure 72a). Portions of both faces have been removed by potlidding, but enough remains to determine this specimen was 6.0 mm in maximum thickness. The base appears unmodified, but the construction details may have been removed by the snap fracture that is responsible for the concave shape of the base.

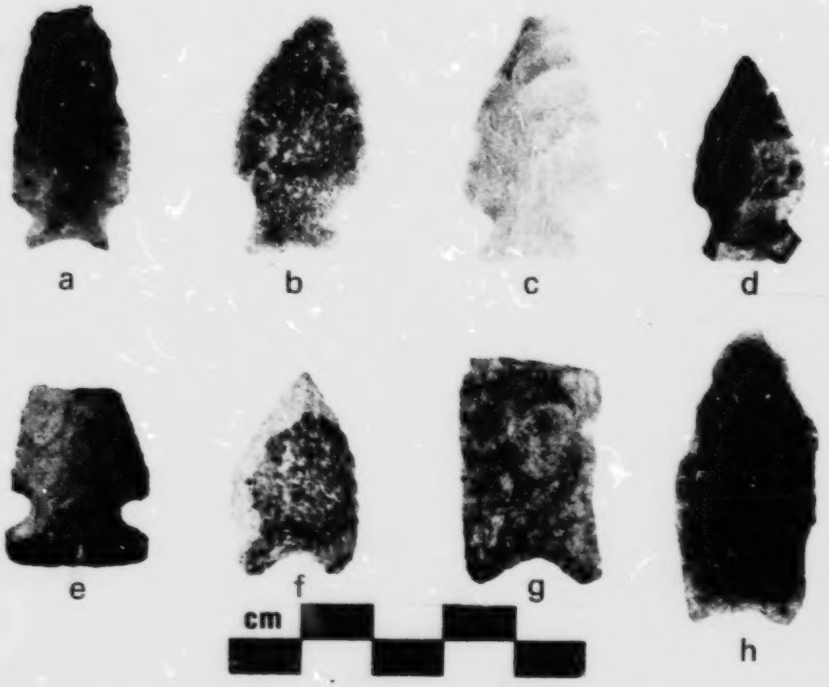


Figure 72. Projectile points from FlQs-30.

FlQs-30-182: This complete grey spicular chert side-notched flake point is 4.2 mm thick and weighs 2.1 g (Figure 72d). Grinding occurs on the base and stem edges. Minute nibbling retouch on the blade edges suggests use as a knife.

FlQs-30-192: This is a side/corner-notched chert point with broad, deep notches, obtuse shoulders and a slightly concave base (Figure 72c). It is 6.0 mm thick and weights 4.3 g. Although the stylistic relationship of this specimen can not be specified, a slight resemblance to some Pelican Lake variants recognized on the Plains and in the southern Rockies is noted.

FlQs-30-264: This is a long, narrow triangular bladed side-notched or stemmed silicified mudstone point with very broad deep notches (Figure 74i). The maximum thickness is 6.4 mm. Although both basal corners have been broken off, enough of the base remains to indicate that it was ground and had a slightly concave shape.

FlQs-30-402: This silicified siltstone specimen is large side-notched point with a broad, ovate blade, deep broad notches, rounded basal edges and a slight basal concavity (Figure 73h). It is 7.2 mm thick and weighs 10.2 g. The base has not been ground. This point does not overtly resemble any previously defined Plains or Plateau type. Its form is quite similar to a point illustrated by Spurling (1980:Figure 57d) from the Upper Peace River which has been classified with McKean Complex materials, but no such ascription is made here. Rather, we believe it is probably one of a variety of localized northern styles.

FlQs-30-502: This chert specimen is a reworked side-notched point fragment (Figure 74n). The snap fracture which truncated this specimen has been used as the platform for removal of a burin spall. This burination removed one shoulder. The resulting bit has been worn from use. The one remaining shoulder is rounded, the notches are deep and broad. The base is quite straight and has not been ground. It is 5.0 mm thick.

FlQs-548: This is a small lanceolate complete silicified siltstone point with excurvate blade edges which contract proximally giving a waisted appearance (Figure 73g). It is 5.7 mm thick and weights 2.7 g. Its distinctive basal indentation results in its designation as a McKean type.

FlQs-30-692: This is a parallel-sided, basally indented lanceolate silicified mudstone point with the tip missing (Figure 72g). A potlid scar has removed much of one face. This specimen is 2.8 mm thick. It is classified as a McKean type.

FlQs-30-875: This is a complete quartzite point with an ovate blade, broad, deep side notches and sharp shoulders (Figure 72b). Basal corners are acute but slightly rounded, and the base is only slightly concave. The notches and basal edge has been ground. This specimen is 6.2 mm thick and weighs 4.4 g. It exhibits some stylistic resemblances to specimens from Jasper Park (Anderson and Reeves 1975:Plate 18:U) which have been attributed to Boreal Forest or Plateau influences.

FlQs-30-883: This is a concave-based lanceolate vitreous quartzite point with irregular excurvate lateral edges and crude flaking (Figure 72h). The proximal portion of the lateral edges have been ground. It is 7.6 mm thick and weights 6.4 g.

FlQs-30-921: This largely complete blade/base fragment of silicified mudstone has moderately deep, rounded notches and square shoulders

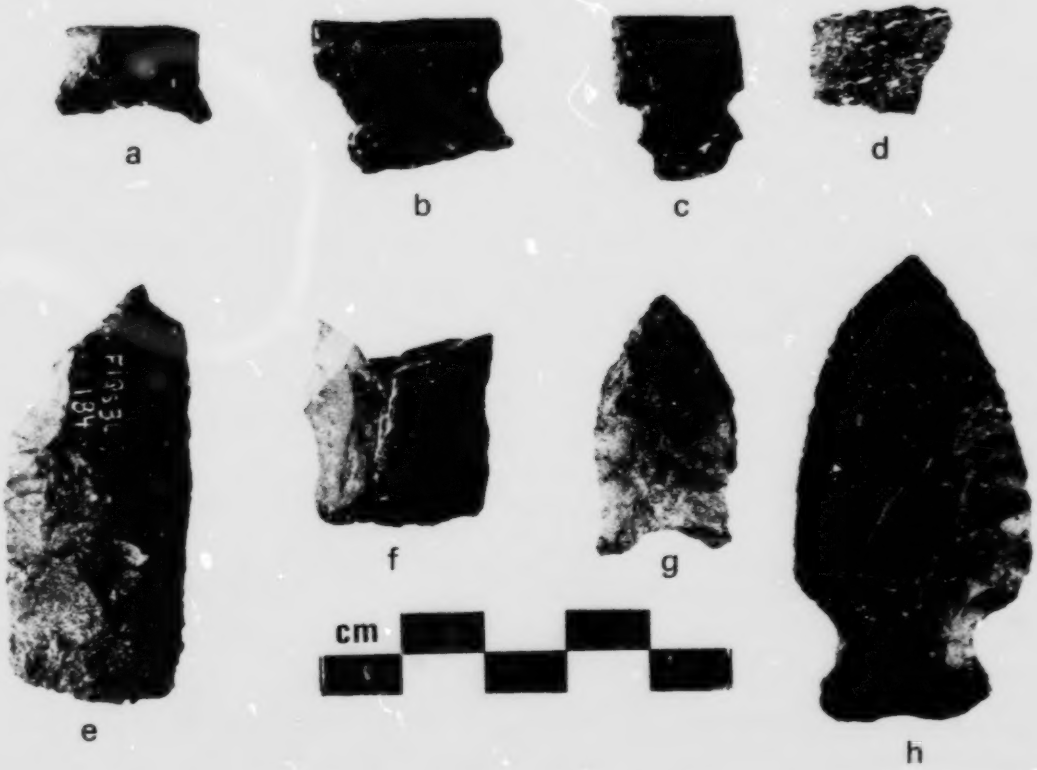


Figure 73. Artifacts from FlQs-30. Projectile points: a-d, g, h; hafted bifaces: e, f.

(Figure 72e). The basal corners are square and the base is straight. The base, stem and notch edges are heavily ground. It is 5.5 m thick and weights 3.4 g. It strongly resembles specimens classified as Bitterroot from areas further south along the Eastern Slopes.

FlQs-30-977: This silicified siltstone specimen is a small concave based lanceolate point (Figure 72f). Reworking of the lateral edges has given it a pentagonal shape. It is 5.7 mm thick and weights 2.7 g. It is classified as belonging to the McKean type.

A considerable number of the points in the sample are represented by basal fragments. In general, insufficient characteristics remain to permit identification. Three are totally unidentifiable as to form. One specimen of quartzite and two of silicified siltstone can be interpreted as side-notched unclassifiable forms (Figures 74h, 73b and c). Two chert

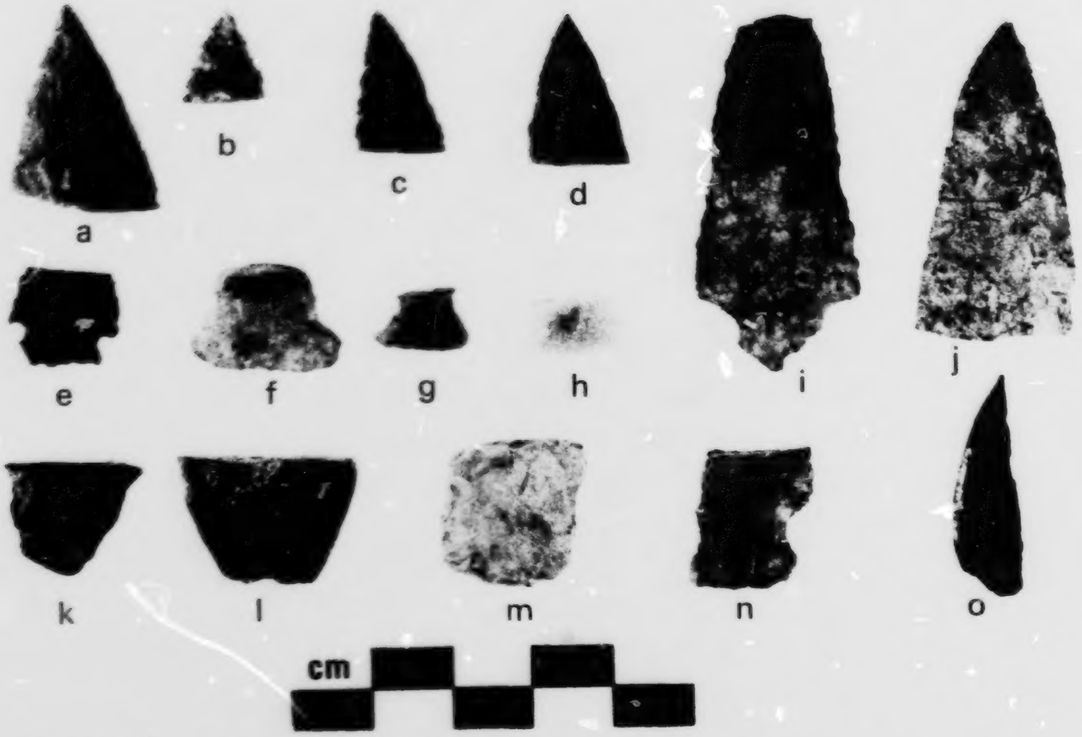


Figure 74. Artifacts from FlQs-30. Projectile point fragments: a-j, m, n, o; hafted bifaces: k, l.

specimens are sufficiently small and thin that they may represent Late Period arrow points (Figure 11e and g). Possible Middle Period specimens are represented by a thick, notched silicified limestone specimen (Figure 74f) and an indented base/blade fragment of chert (Figure 74o). One possible Early Period specimen is represented by a square-based stemmed fragment made of mudstone (Figure 74m). Finally, a possible Late northern variant is represented by a "waisted" slightly indented base lanceolate form of silicified siltstone (Figure 73a).

Fewer specimens in the point collection are represented by fragmentary tips (n=5). These exhibit even less diagnostic traits than basal fragments. Three chert specimens are sufficiently small and thin to be interpreted as possibly representing Late Period arrow points (Figure 74b, c and d). Larger, thicker specimens (553, 712) of silicified limestone (Figure 74j) and chert (Figure 74a) may represent Middle Period specimens.

Endscrapers (n=18)

All of the endscrapers have steep unifacial retouch extending onto the dorsal face of the flake blank forming a mildly convex to semicircular convex working edge. Four have been made on decortication flakes and are square (n=1), trianguloid (n=1) or ovoid (n=2) in form. Three are made on dorsally finished rectanguloid expanding flakes. Three have been made on square flakes with retouch only on the distal margin while two exhibit retouch on four margins and are asymetrically quadrilateral in form. Four are simply irregular in form with single margin retouch. A proximal bit fragment and a distal-lateral edge fragment are also present in the sample. Lithic types used highlight the finer quality materials: Knife River Flint (n=1), chert (n=11), siltstone (n=4), mudstone (n=1) and quartzite (n=1).

Quartzite Spall Unifaces (n=2)

These are large ovoid quartzite spalls with dorsal modification to moderately steep angles (70^0) around their entire peripheries (Figure 75d and e). A scraping or planing function is inferred.

Bifaces (n=40)

Four hafted specimens were identified in the assemblage, only one of which is complete. The complete biface is rectangularly lanceolate in form with the distal end formed by an oblique lateral edge (Figure 73e). The other three are proximal ends of presumably lanceolate forms. One is rectangular with a straight base and a shallow notch on one lateral edge (Figure 73f). The others exhibit proximally contracting lateral edges with slightly convex and rounded bases respectively (Figure 74k and l). Haft modifications in the form of retouch or edge grinding are present on all specimens.

Unhafted specimens vary in form and extent of modification. Three are small and triangular in form (Figure 76a and b), two are larger and ovate in outline (Figures 75a and 76g), and two represent preforms of ellipsoid and oval (Figure 76h) form, respectively. Modification ranges from complete, well-controlled bifacial thinning to crude thinning with only marginal retouch on the opposite face.

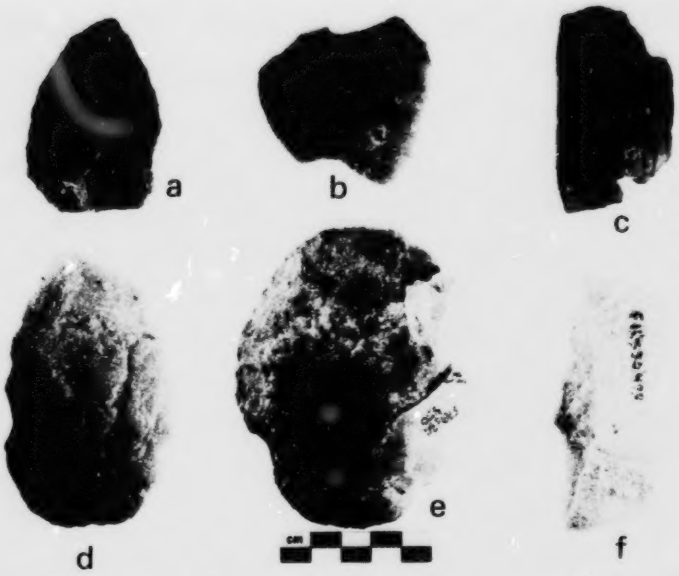


Figure 75. Artifacts from FlQs-30. Biface: a; marginally retouched flake tools: b, f; cut and grooved steatite slab: c; spall unifaces: d, e.

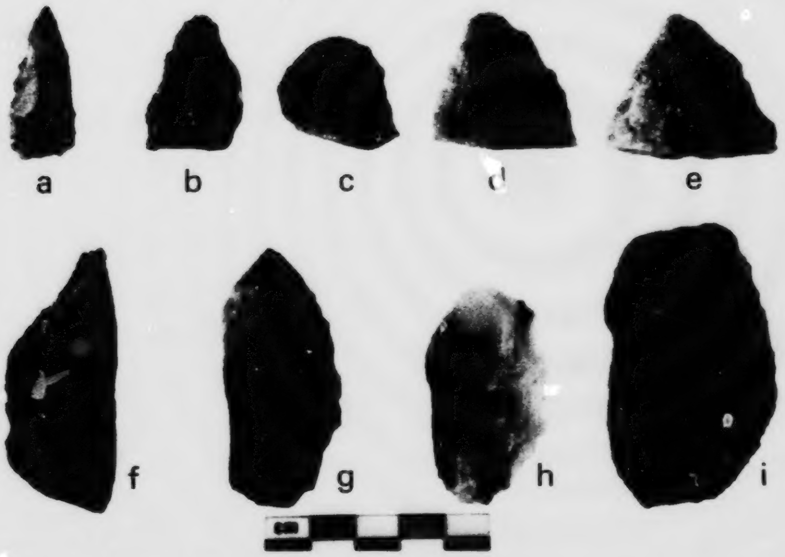

a
b
c
d
e
f
g
h
i
cm

Figure 76. Bifaces from FlQs-30.

A bifacially formed drill bit also occurs in the assemblage. It has a diamond-shaped cross section, a chisel shaped tip and is finely worked. The basal portion is missing. A bifacially worked side scraper was also identified (Figure 76i). It is a completely bifacially flaked rectanguloid form with a convex single bevelled working edge along one lateral margin. Lateral smoothing suggests this specimen may have been hafted.

Biface fragments are numerous in the assemblage. These consist of six ovate and bipointed biface tips, four ovate or oval end fragments (Figure 76c), four large biface tips (Figure 76d and e) or corners, five midsection fragments, and eight edge segments (Figure 76f). As with other formed tools, the better quality materials tend to be more commonly used in biface production. Twelve are chert; seven are silicified siltstone; two are silicified mudstone; seventeen are quartzite; and two are silicified sandstone.

Marginally Retouched and Utilized Flakes (n=156)

These are the most common type of tool recognized in the assemblage (Figure 75b and f). Forty-six have been classified as sidescrapers based on the lateral location of use wear and their steep edge angles. At least seven of these exhibit deliberate edge modification. Ten have been classified as spokeshaves because of their concave working edges and moderately steep edge angles. One specimen has marginal unifacial retouch on four straight to slightly concave edges. Four appear to have been used as gravers or awls because of the distinction use wear recognized on isolated projections. Only one of these does not exhibit purposeful modification.

Less distinctive types recognized in the sample include two specimens with straight, bifacially flaked lateral edges, one marginally retouched preform and sixteen with convex, unifacially retouched working edges. Twenty-one edge fragments were also identified. Fifty-six specimens, exhibiting a variety of shapes and edge morphologies, were classified simply as miscellaneous utilized flakes.

Cores (n=51)

Specimens representing core reduction strategies are overwhelmingly dominated by bipolar pebble cores of chert (28), quartzite (5), silicified siltstone (3), and silicified mudstone (2) (Figure 77). The majority exhibit unidirectional impact. Also represented are four quartzite cobble cores, two quartzite spall cores and two multidirectional irregular cores (quartzite and chert). Two specimens are classified as subconical prepared core fragments (Figure 77o and p). Both are truncated. Finally three specimens are classified as "other" cores representing a pebble from which a few flakes have been driven, a small bifacial core and a bifacial core fragment, respectively.

Other Tools

One thick quartzite spall chopper and one large tabular sandstone anvil were also recognized in the assemblage.

Ground Stone Artifact

One artifact (Figure 75c) appears to be a waste by-product of the manufacture of a ground stone artifact. It is made from a thin, tabular, roughly rectangular slab of steatite. The long lateral edges are bevelled cut marks. A 1 mm deep linear incision near one of the cut margins may represent an imcomplete cutting attempt.

Lithic Artifact Distribution

As mentioned above, all lithic artifacts were individually piece plotted in the field by functional category. As was noted, however, subsequent cleaning and examination revealed a fair number of tools and tool fragments went undetected and were plotted as flakes. Since flakes were bulk bagged after being individually plotted, it was not possible to enter the revised identifications. The distribution maps shown in Figure 78 are generally correct for the major formed tools, but the category of retouched/utilized flake should be increased by about 100 specimens. Flakes would be correspondingly decreased. Otherwise, these maps give an accurate impression of the distribution of chipped stone at FlQs-30.

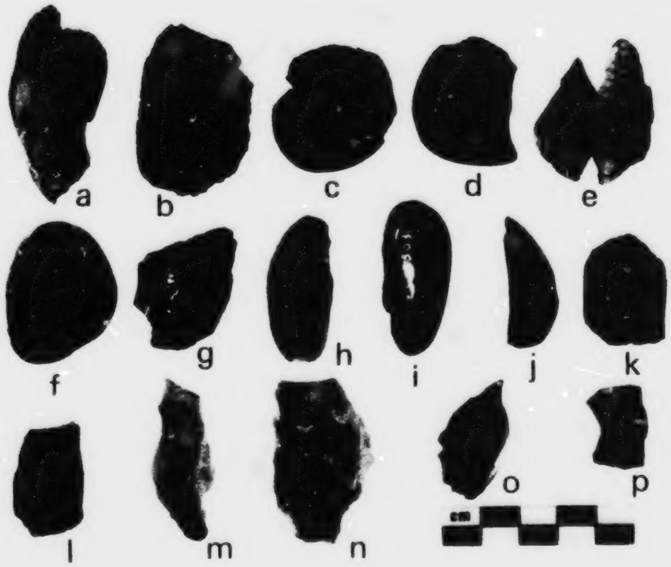


Figure 77. Cores from FlQs-30, Bipolar cores: a-l; multidirectional core: m; bifacial core: n; subconical core fragments: o, p.

Although lithic artifacts were recovered from the entire block excavation, some distributional patterns are evident. In general, the eastern third of the block (units 8, 11, 12, 14, 15) contained noticeably fewer amounts of chipped stone than the remaining units, suggesting that this area was somewhat peripheral to the major utilization of lithic artifacts at FlQs-30. Similarly, one can observe several concentrations of lithic artifacts in the central strip of the excavation area. The area around unit 13 was especially rich in both flakes and formed tools (unifaces, cores, points and debitage), suggesting that the manufacture, use and repair of tools was a frequent here. A smaller but more tightly clustered concentration of flakes and tools occurs near the north end of unit 4. Unifaces and cores are almost the only formed pieces found in this area.

Also noteworthy are the several concentrations of debitage found at the site (Figure 78). While a few of these are relatively diffuse, several (units 4, 6 and 7) are clustered in a manner suggestive of individual knapping episodes. Many of the debitage clusters also have cores in the immediate vicinity; however, this association may be strictly fortuitous. Again, the bulk bagging of debitage prevents

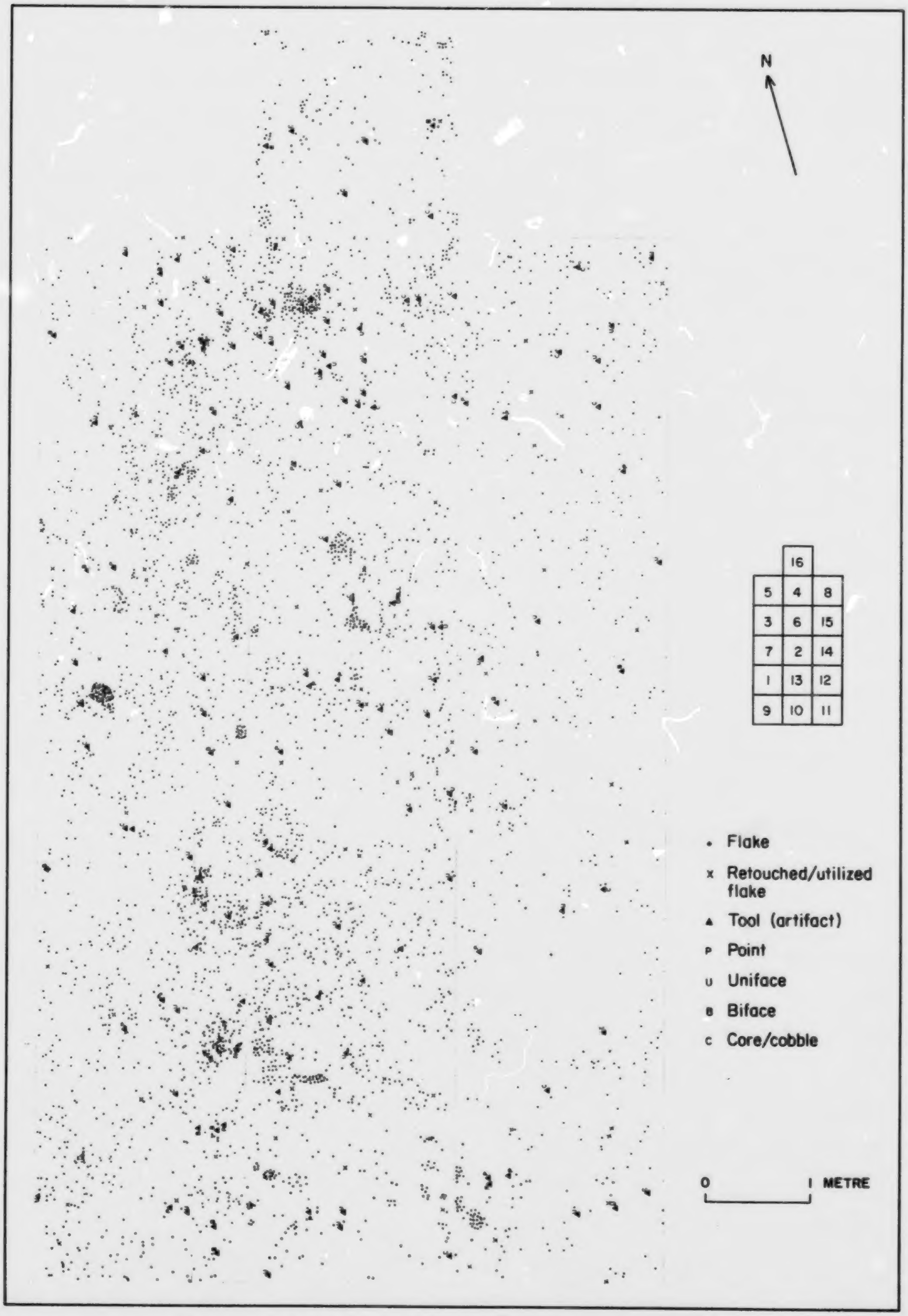

N
16
5
4
8
3
6
15
7
2
14
1
13
12
9
10
11
• Flake
x Retouched/utilized flake
▲ Tool (artifact)
P Point
U Uniface
B Biface
C Core/cobble
0
1 METRE

Figure 78. Lithic artifact distribution at FlQs-30.

comparison of the clustered debitage with associated cores to see if the material types correspond. However, it was also noted during excavation that many of these flake concentrations were composed primarily of identical lithic materials, supporting the interpretation that these clusters represent the remains of individual knapping episodes.

Visual inspection of the lithic distribution maps can easily produce clusters of tools or specific tool categories, but the widespread nature of the tool distribution does not lend itself toward confident identification of specific tool use and discard areas. More useful might be the contrast between the western two-thirds and the eastern third of the rectangular excavation block indicating tool use and discard was heaviest in the western areas of the excavation. Repeated occupation of the site, however, may have resulted in a widespread distribution of tools and a concommitant loss of discrete patterns.

Faunal Remains

Faunal material was recovered from all one metre quadrants within the block excavation area. Typical of shallowly buried, unstratified sites in acidic mountain soils, the faunal remains were badly eroded, poorly preserved and highly fragmented. It is estimated that approximately 23,441 pieces were recovered. Figure 79 plots the distribution of bone fragments by weight.

Not a single bone was recovered which measured more than 5 cm in any dimension. The total weight for all bone was 2977.7 g, averaging 0.13 g per bone specimen. Obviously, identification of bone element and genus/species was seriously hampered by the condition of the sample. Only nineteen fragments were identified to the level of species. The vast majority of the sample (probably 95%) was comprised of tiny fragments of thick-walled bones believed to be from large mammals such as moose, elk, deer, sheep or bear. Precise identification tends to be skewed towards the small mammal community, no doubt reflecting the fact that certain very small dense bones, such as phalanges of small mammals, can survive and still be identified.

The four positively identified animals are *Castor canadensis* (beaver), *Lepus americanus* (snowshoe hare), *Rangifer tarandus* (caribou), and *Ondatra zibethicus* (muskrat). The number of identifiable specimens

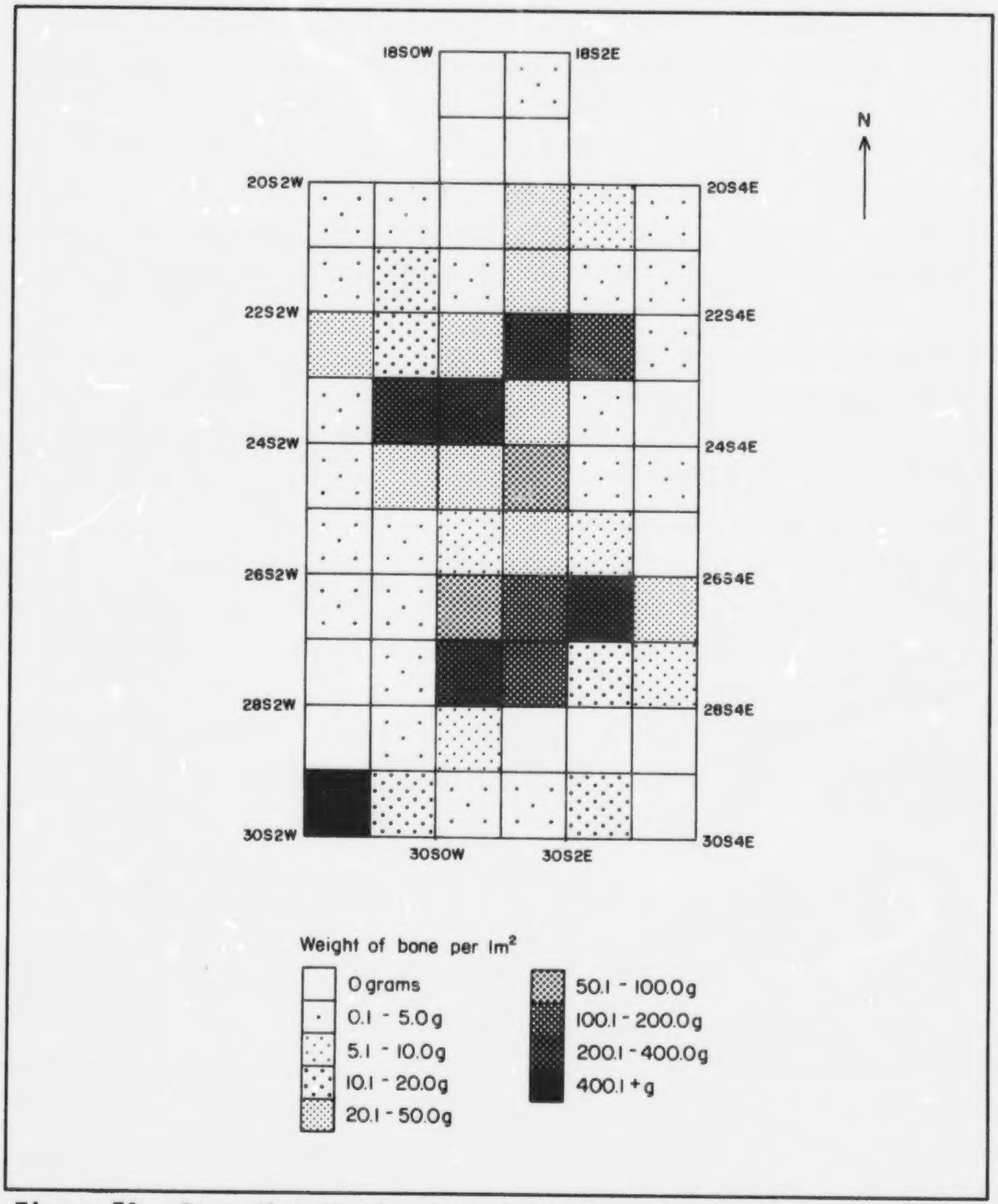

18S0W
18S2E
N
20S2W
20S4E
22S2W
22S4E
24S2W
24S4E
26S2W
26S4E
28S2W
28S4E
30S2W
30S4E
30S0W
30S2E
Weight of bone per $1m^2$
0 grams
0.1 - 5.0g
5.1 - 10.0g
10.1 - 20.0g
20.1 - 50.0g
50.1 - 100.0g
100.1 - 200.0g
200.1 - 400.0g
400.1 + g

Figure 79. Bone distribution by weight at the Grande Cache Lake site (FlQs-30).

(NISP) for beaver is sixteen; hare and muskrat, five each; and three for caribou. Several bones were tentatively identified as marmota, probably the hoary marmot. Others were identified as large carnivore (probably bear) or as smaller carnivore (probably cougar). A few bones were selected as probably being from small mammals, but the great bulk can only be said to be large mammal. A single fish scale was recovered from level 3 of unit 2. This scale has been identified as *Catostomus commersoni*, the common white sucker. No annuli were noted on the scale, hence no seasonality could be determined from this specimen.

Many of the bone fragments were charred or calcined. This may be due to intentional burning in cultural contexts, such as for fuel or in cooking. Likewise, the fragmentary nature of the bone may be interpreted as a result of cultural processing for grease extraction (Leechman 1951). This activity would likely produce the configuration of faunal remains found at the Grande Cache Lake site (see Binford 1978; Vehik 1977). On the other hand, in situ decomposition of bone elements in highly acidic soil could also produce a similar configuration (see Brink et al. 1985; Tappen 1969; Tappen and Peske 1970). The calcined condition of the bone does not necessarily support either interpretation. Natural forest fires were presumably a common feature of the prehistoric environment and could have caused fresh greasy surface bones to burn. Likewise, bone could have burned as fuel or been charred or calcined by virtue of its proximity to hearths around the campsite.

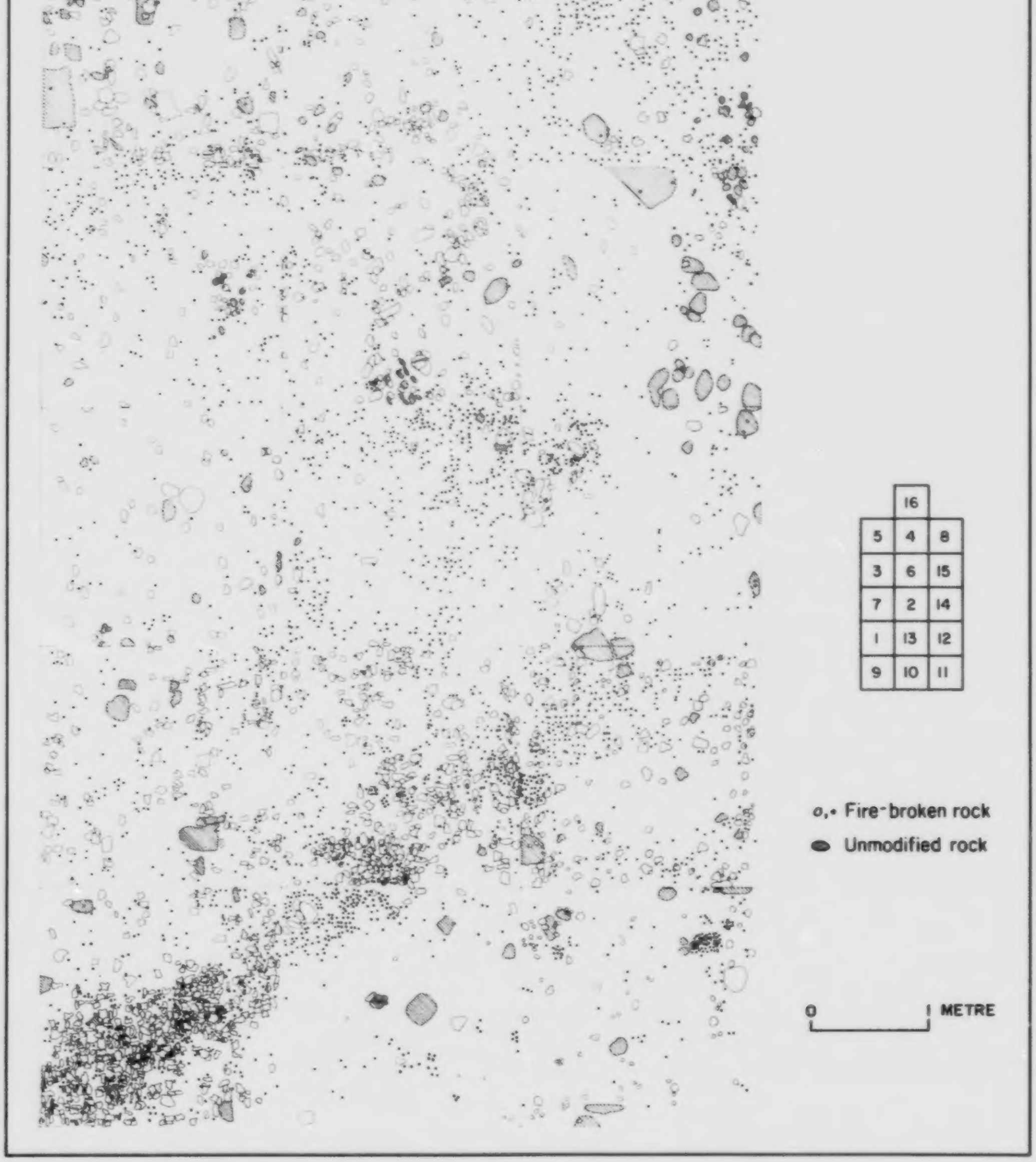
Features

The shallow and compressed cultural deposits representing numerous occupation events made recognition of site features difficult. With bone fragments, fire-broken rock and lithic remains blanketing the entire excavation area, it was often not possible to detect clusters or concentrations during excavation. Also, stains, or mottling, of the loess soils were fairly common and could not usually be attributed to cultural activity. Forest fires, tree throw and animal activity likely produced a number of the stains observed. For these reasons, features were identified when we were convinced that the excavated materials were indicative of the actions of past site inhabitants. No doubt many less distinct features, and those seriously disturbed by subsequent prehistoric occupations, went undetected. We believe our low number of features is an artifact of the nature of the archaeological record at FlQs-30 and not a true indication of the events and processes which transpired at the site. We recorded three definite features. Several stains, and/or FBR and bone occurrences were noted. Some were mapped and photographed, but it was subsequently decided that definite feature status could not be assigned.

Feature #1

The most extensive and distinct feature discovered at FlQs-30 was feature #1, located in excavation unit 9 at the southwest end of the block. It no doubt continues further to the south and west, but likely the majority was excavated. The existence of the feature became apparent in level 1 (0-10 cm) and was marked by enormous quantities of small, quartzite fire-broken rocks (FBR) appearing as a nearly solid pavement of rock which trended diagonally across the unit from SW to NE (Figure 80) and into the NW corner of unit 10 and across the southern half of unit 13. Whether this is all part of one large FBR feature or whether a second feature existed in unit 13 is unknown, but we tend to favour the latter view. In unit 9, the FBR was mixed in with several thousand tiny calcined and charred bone fragments, weighing 640 g and representing the largest density of bone found anywhere at the site (see Figure 79). Although not a single piece could be identified, it is apparent that nearly all are from of medium to large mammals. While taphonomic processes could have produced the fragmentation observed, the charred and calcined nature of the bone combined with its context in a stained soil and with the surrounding mass of FBR strongly argues for cultural processing.

The soil matrix in level 1, mixed with the bone and FBR, was a darker, mottled silt with flecks of charcoal. No true stain boundary was apparent in level 1. However, as the FBR and bone were removed and the unit was excavated into level 2, a distinct circular stain consisting of a dark black organic rich soil with abundant charcoal flakes and burned and calcined bone fragments became apparent (Figure 81). It measured 50 cm in diameter, was basin shaped, at least 10 cm deep and appears to represent a sub-surface pit. The feature is not a hearth stain as there is no evidence of oxidation. Charcoal flecks collected from this stain were the source of the radiocarbon date of 1770 ± 170 years B.P., the most recent acceptable radiocarbon date for the site.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o,• Fire-broken rock
Unmodified rock
0
1 METRE

Figure 80. Fire-broken rock distribution at FlQs-30.

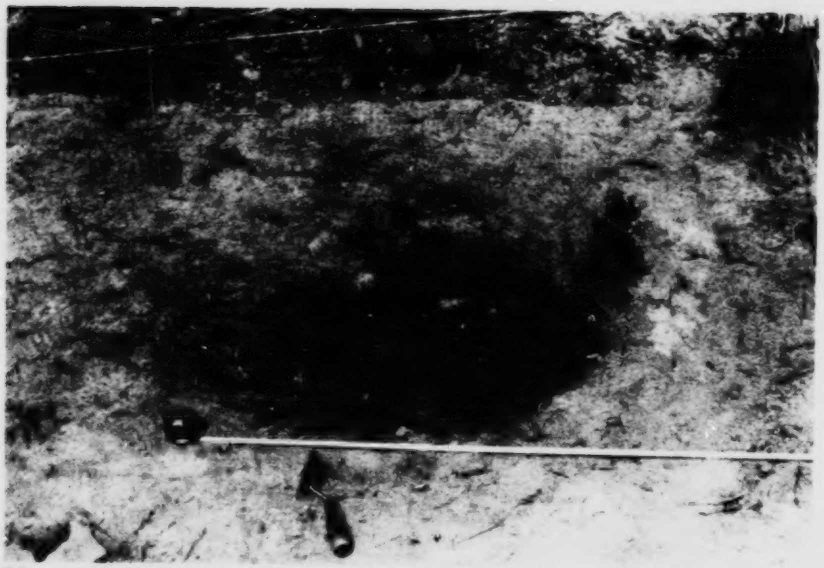

Figure 81. Feature #1, level two, at FlQs-30.

Assuming the concentration of FBR, fragmented bone and dark-stained soil are indeed associated, the most likely interpretations are that this feature served either as place for cooking, boiling or roasting food in a hide-lined pit, or perhaps a combination of these. Although the highly fragmented nature of the bone is strongly suggestive of bone boiling for grease extraction (see Binford 1978; Leechman 1951), the calcined and charred condition of the bone is not a product of such activity (see Chapter 5 in Brink et al. 1985), neither could it be due to roasting and cooking food in a pit. It is quite possible, however, that the bone was burned and calcined by a nearby hearth or through forest fires sometime after the use of the feature. The great number of small FBR pieces is more suggestive of repeated heating of rocks for stone boiling in the pit - either to cook food or extract bone grease - than of food roasting where larger cobbles of rock would likely be employed.

If this was a hide-lined pit, the fact that the lower, dark circular stain in level 2 generally lacked bone and FBR suggests that the hide was removed after use. Thus, the bone and FBR, which presumably were part of the pit at one time, were distributed over the surrounding area and not in the bottom of the pit itself. Given the long, linear distribution of both FBR and bone diagonally across units 9, 10 and 13, it is tempting to suggest that the pit hide was pulled off in this direction, leaving a trail of the pit contents (see Figure 80). In sum, it seems fair to conclude that feature #1 was a sub-surface pit feature which was probably used to cook food or extract bone grease from medium and/or large mammals.

Feature #2

This small feature consists of a cluster of fire-broken rock pieces and some apparently unmodified quartzite rocks in the centre of the eastern half of unit 3, in the bottom of level 1 and top of level 2 (see Figure 80). The cluster was a single layer, roughly oval in plan form, measuring about 50 cm on the long axis and 35 cm across. The soil around and inside the rock cluster was stained a mottled brown. Large amounts of both burned and unburned bone fragments were recovered from around the rocks and especially to the south side of the cluster. In total, nearly 1000 bone fragments weighing 350 g were recovered from the southeast 1x1 m quadrant of unit 3 (see Figure 79).

Again the exact function of this feature is problematical. The amount of FBR present is quite small compared with other areas; however, the distinct clustering of the rocks in an area where little FBR was recovered, coupled with the associated stained soil and bone concentration, strongly suggests the presence of a discrete feature. Since no pit was discovered, a hearth function seems the most likely interpretation. The mottled brown soil stain could be a result of mixing oxidized and unoxidized soils.

Feature #3

The third feature was located about 1 m north of feature #2 in level 1 in the SE corner of unit 5 (see Figure 80). Much like feature #2, feature #3 consists of a cluster of FBR and stained soil. However, very little bone was associated with the rock concentration. The FBR cluster was about 75 cm long and 50 cm wide and consisted of a single layer of about forty small quartzite fragments. The soil around the rocks was a mottled brown stain. Only 75 small, unidentifiable bone fragments, both burned and unburned, weighing about 12 g, were recovered from the SE quadrant of unit 5. Similarly small amounts of bone were recovered from the adjoining portions of the surrounding units.

Like feature #2, a function for this small feature is difficult to identify. Again, there is no evidence of a pit, and the scarcity of bone argues against food preparation in the immediate feature area. The soil staining is essentially identical to that of feature #2, and a hearth function seems the most likely interpretation.

GaQs-1: THE SMOKY SITE

Introduction

The Smoky site (GaQs-1) is situated on the north bank of the Smoky River, immediately opposite the confluence of the Smoky and Muskeg rivers, about 20 km northeast of the town of Grande Cache. Like FlQs-30, the Smoky site is situated in an ecotone, or transition zone between the montane environment to the west and the expansive boreal forest to the east and north. The rounded, timbered foothills in the site vicinity generally attain heights of 1500-1600 m A.S.L., although a few extend above tree line (c. 1800 m). The hills and mountains are composed mainly of Cretaceous deposits (Irish 1965), all of which exhibit thrusting, faulting, anticlines and synclines. Surficial deposits are composed mainly of colluvium, loess and glacial meltwater deposits. The primary surficial cap over the whole Smoky valley is a fine, buff-coloured loess. The valley in the immediate site area is generally deep and narrow and appears unglaciated, or minimally glaciated, downstream from its confluence with the Sulphur River. At the Smoky site, loess deposition did not exceed 50 cm and averaged about 25 cm.

Parent material of sandstone bedrock was only encountered, and outcropped, along the western margin of the site terrace in the area referred to as locality 3 (see below). Here loess lay directly over the bedrock. Over the rest of the site, loess capped alluvial deposits of highly calcareous river gravels, silts and clays occur. Because the upper soil - the loess - does not originate from the local parent material, a discontinuity, marked by a sharp change in soil colour and texture or by the presence of large quartzite river cobbles, is present in the profile. The soil profile at the site consists of a thin (c. 5cm) leaf litter mat, underlain by an Ah organic horizon usually 5 cm thick. Below this is an unstratified buff to reddish coloured loess Bf horizon averaging about 25 cm in thickness. All cultural materials were contained exclusively in the loess horizon, with the exception of a few units where artifacts were recovered from clearly disturbed contexts in the basal alluvium.

The vegetation at the site is a mixture of boreal and sub-alpine communities (Hosie 1969). The dominant tree cover at the site is trembling aspen which makes up about 80 percent of the local community. The remainder is composed of Balsam poplar and to a lesser extent, white spruce. Ground cover is dominated by wild rose bushes and also includes wild pea, indian paintbrush, strawberry, bearberry, common yarrow, wolf willow, Canadian buffalo-berry and bromegrass. Some sage brush was noted on the south-facing steep slopes of the terrace. Fauna for the Smoky site area is essentially the same as has already been described for the region.

The Smoky site lies on a point of land which juts into the river (Figure 82). The site surface is generally undulating and slopes downward in the direction of the river. Few level areas exist, except at the northeast end where the prominent terrace begins. At some date before 1969, a bulldozer was brought to the site and bladed a ditch from the apex of the point along the northeast wing to channel runoff into a culvert. It was this exposure which led to the discovery of prehistoric cultural materials by Bonnichsen and Elliott in 1969.

The recovery of a Clovis projectile point led to our decision to excavate in 1974-75. This point was taken to the laboratory of archaeology at the University of Alberta, but unfortunately was lost and was never photographed or described. According to Bonnichsen, it was said to be the "true" Clovis form, that is, similar to those from the Great Plains such as at Blackwater Draw. Thus, it differs from many other fluted points found in Alberta believed to be a variant of the "true" Clovis form (Gryba 1985; Vickers 1986). The point was complete, about 6 cm long and 2.5 cm wide, made from a curved flake of a rich, jet black chert of high quality, and was fluted on one face. The lateral edges were excurvate, the base concave and ground, the flutes were short and multiple on one side due to the curvature of the flake. The obverse side was apparently unfluted. The transverse cross section was said to

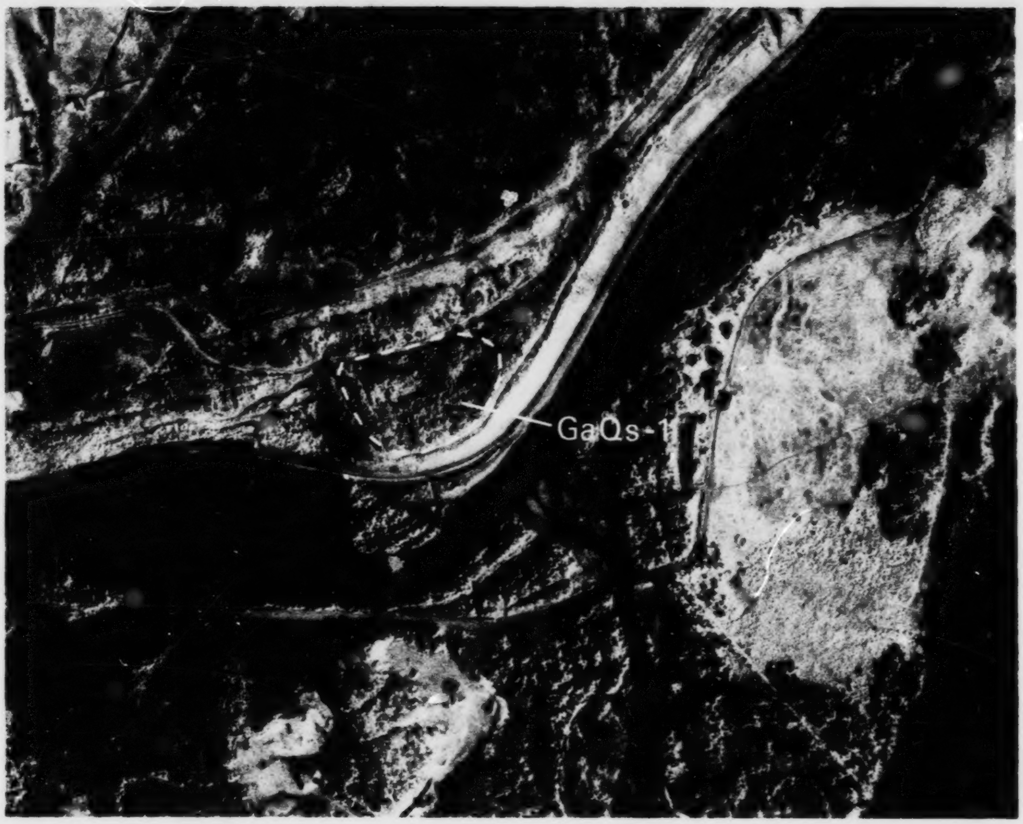

Figure 82. Aerial view of the Smoky site (GaQs-1).

be lenticular. Our excavation failed to yield any additional Clovis material.

Excavation Methodology

Our interest at the Smoky site centred around an attempt to locate undisturbed Clovis materials, and no major block excavations were conducted. Unit placement was entirely judgemental, based first on the approximate location of the Clovis find as described by Bonnichsen, and later on subjective assessment of potentially fruitful areas to excavate.

The site area can be viewed as three separate localities, each of which was tested with a separate baseline and grid system (Figure 83). The northeast wing of the point bar, designated locality 1, was tested with a total of 24 excavation units of various sizes (units 1-24, 28). Locality 2, the apex of the point bar, and was tested with four

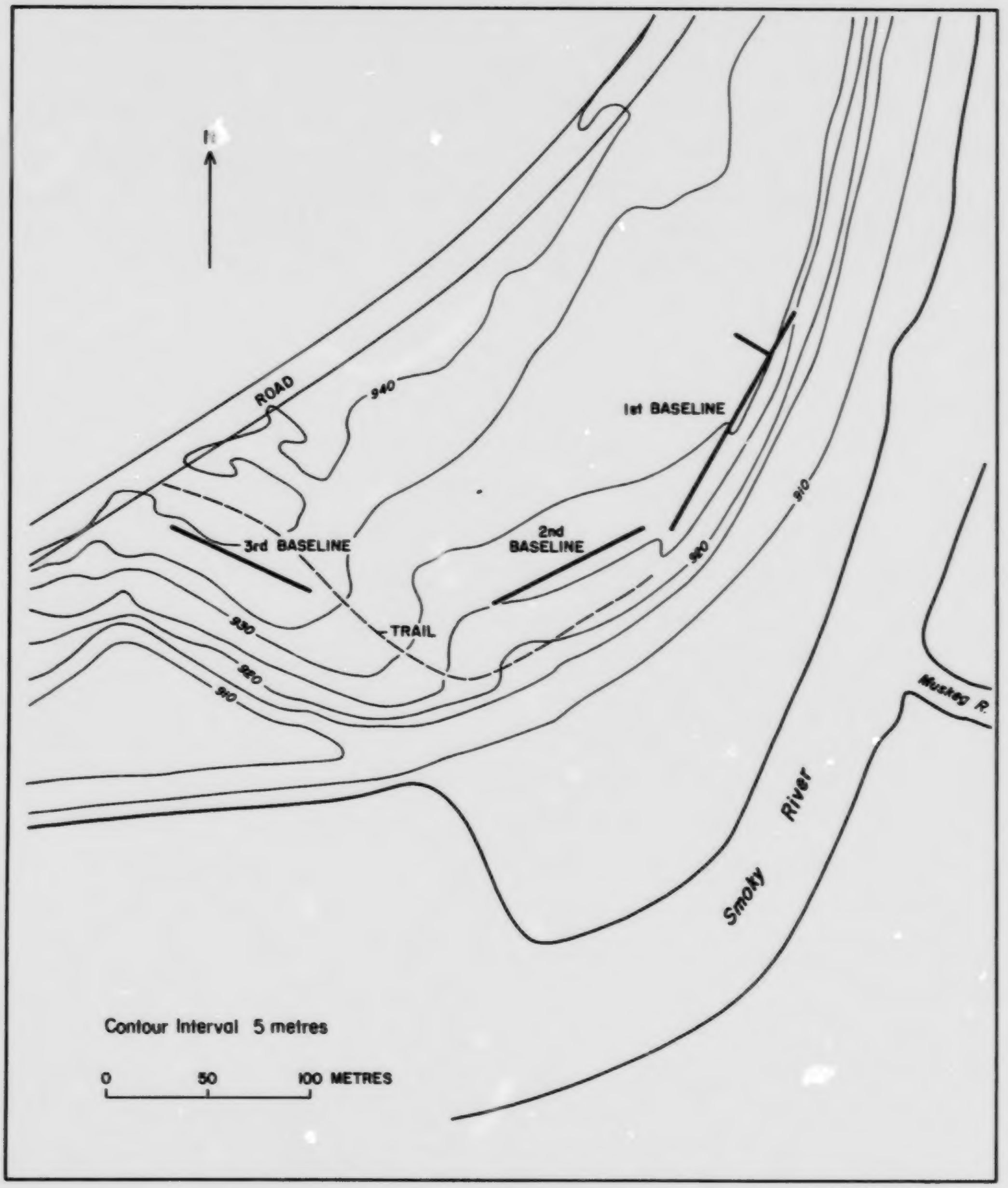
N
ROAD
940
1st BASELINE
910
920
2nd BASELINE
3rd BASELINE
TRAIL
930
920
910
Muskeg R.
Smoky River
Contour Interval 5 metres
0
50
100 METRES

Figure 83. Map of site showing location of baseline tests.

excavations (units 25-27, 29). Locality 3 parallels the uphill climb of the northwest wing of the point bar where the inclined bedrock outcrops and was tested with fifteen excavation units, again of various sizes (units 30-45) (Figure 84). The range of unit sizes employed included: 0.5x4 m, 0.5x5 m, 0.5x6 m and 1x3 m trenches; 2x2 m, 1x2 m, 1x1 m and

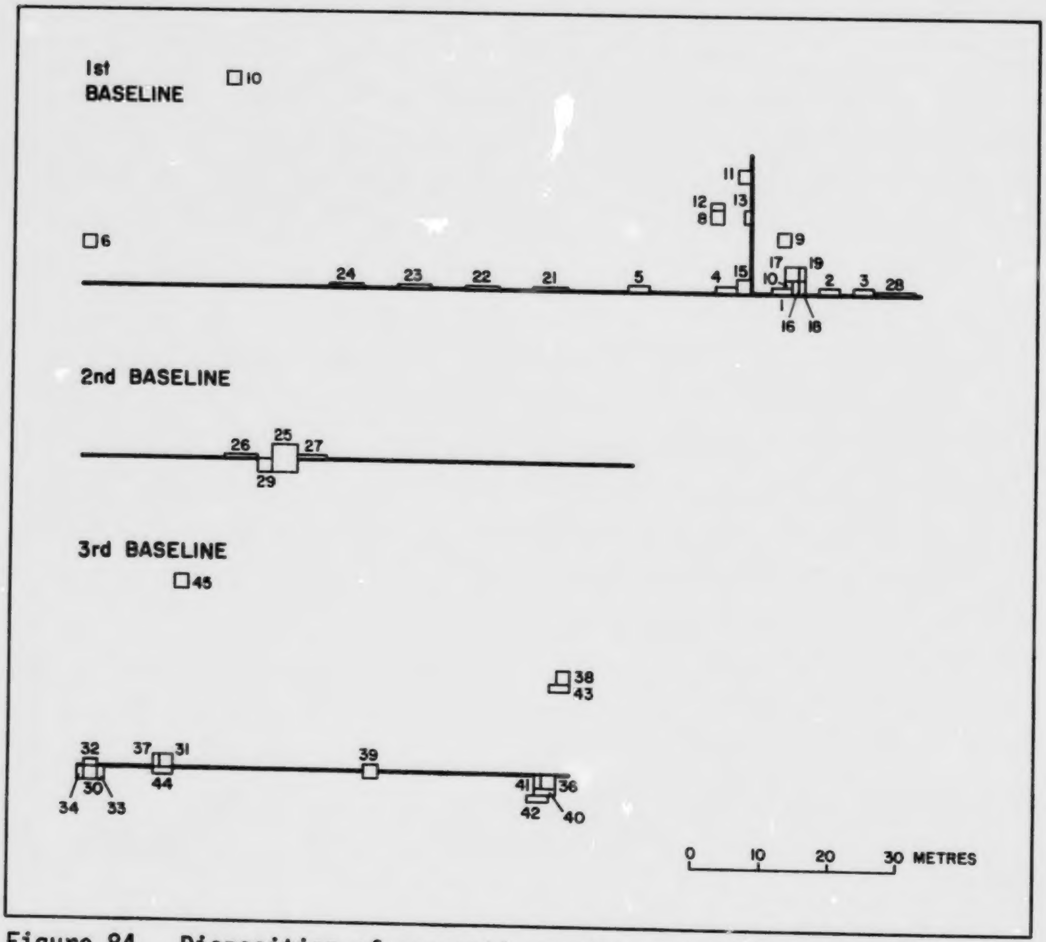
1st BASELINE
10
11
12
13
8
6
9
17
19
24
23
22
21
5
4
15
10
2
3
28
1
16
18
2nd BASELINE
26
25
27
29
3rd BASELINE
45
38
43
32
37
31
39
30
44
41
36
34
33
42
40
0
10
20
30 METRES

Figure 84. Disposition of excavation units on baseline tests at the Smoky site.

4x4 m units. In total, 139.5 square metres of site area was excavated over the 1974/75 seasons. Excavations were placed around the periphery of the point bar over a linear distance of some 400 m. How far into the interior of the point bar cultural materials may extend is largely unknown. We would roughly estimate that the site covers at least some 10,000 square m and could be two or three times this figure.

Excavations began at locality 1 in 1974 where we believed the Clovis point had been found. Knowing nothing of the natural and cultural deposits, the excavation strategy began with the use of arbitrary 10 cm levels. But because artifacts were found throughout the loess horizon without any apparent stratification or vertical separation, we adopted a strategy of excavating in two natural levels, the upper LFH-Ah horizon, and the lower Bf (loess) horizon.

All units were excavated entirely by trowel and similar small tools, and all artifacts were piece plotted on plan maps. The generally low amounts of cultural material allowed us to record and individually bag all artifacts separately. Initially, units were excavated into the sterile alluvium to confirm the absence of any deeper cultural material, but were later terminated at the contact point.

In general, the Smoky site is not a rich site. Many units contained extremely low amounts of cultural material, and some were completely sterile. Excavation probably would have been terminated were it not for the ellusive possibility of encountering buried Clovis materials. Placement of new excavation units tended to follow promising encounters of relatively richer site areas.

Because of the highly dispersed nature of our testing, and because of the generally low yield from many units, analysis of the excavation results provides little information on site activity areas. Instead, we are left with isolated, discrete clusters of data informative primarily as a sample of prehistoric cultural material from an unknown region.

Dating

Dating of the Smoky site suffers from repeated occupation coupled with minimal rates of soil deposition producing a situation of collapsed stratigraphy which negates the possibility of identifying separate temporal occupations. Nevertheless, it was felt that radiocarbon dates could provide some general parameters on the time periods during which the site was occupied.

Rarely encountered, small concentrations of charcoal were noted but were believed to be the result of root burns or other natural phenomena, and no definite hearths were identified. One of the three radiocarbon dates is from a charcoal sample recovered from a large stain which could not readily be attributed to natural processes. The remaining two samples are collections of hundreds of tiny bone pieces recovered from one or more units.

GaQs-1-1: A sample of charcoal weighing 7.5 g collected from 25 cm below surface in unit 25, along the 2nd baseline, associated with a circular stain, returned a date of 1490 ± 140 years B.P. (BIRM. 710).

GaQs-1-2: A sample of hundreds of small bone fragments weighing 184 g collected from 20-40 cm below surface (unit unknown) returned a date of 1940 ± 210 years B.P. (GAK-6140). The laboratory returned a note with this sample indicating that the large standard deviation was due to a low level of organic carbon in the sample.

GaQs-1-3: A sample of hundreds of small bone fragments, both burned and unburned, weighing 247 g collected from 25-45 cm below surface in unit 38 along the 3rd baseline, returned a date of 4490 ± 140 years B.P. (BIRM. 714).

Obviously, the amalgamation of samples from a 20 cm deep layer of loess soil is an unsatisfactory method of dating prehistoric occupations in an area of slow deposition. This practice was necessitated, however, by the general paucity of organic remains. The dates are at least useful to indicate that the Smoky site has been occupied a number of times during the Late and Middle Prehistoric Periods, between about 1500 and 4,500 years B.P. Our samples provide no evidence of an earlier occupation during Paleo-Indian times as suggested by Bonnichsen's recovery of a Clovis point.

Results

Excavation at the Smoky site produced a total of 2,145 lithic artifacts. Fifteen typological categories were established and are displayed in Table 21.

Debitage

Flakes and shatter account for 93.1 percent of the entire lithic assemblage, and ten different raw material types were recognized. From Table 22 it can be seen that chert is the dominant material (57.1%). Other important lithic types include silicified siltstone (14.1%), various mudstones and siltstones (8.2%), various quartzites (11.7%) and quartz crystal (4.6%). Together, these five raw materials make up 95.7 percent of the debitage. The cherts come in a range of colours, and by and large cannot be traced to specific sources. Gravels of the Smoky River were examined and found to contain small chert pebbles matching

Table 21. Summary of lithic artifacts from GaQs-1.

Category	No.	% of Assemblage
Shatter	1543	71.9
Flakes	455	21.2
Utilized flakes	57	2.6
Bipolar cores	26	1.2
Endscrapers	19	0.9
Retouched flakes	15	0.7
Points	10	0.5
Cores	7	0.3
Biface fragments	6	0.3
Choppers	2	0.1
Drills	2	0.1
Hafted Biface	1	0.0
Hammerstone	1	0.0
Pièce esquillée	1	0.0
Ground stone tool	1	0.0
Total	2145	99.8

many of the chert lithics found at the site. Invariably these pebbles were quite small, seldom exceeding 5 cm in any dimension. We believe that most of the cherts found at the site were locally obtained, and thus one would expect the flakes, shatter and tools made from this material to likewise be small in size. As will be shown below, this expectation appears to be true. Larger chert tools are believed to be derived from imported rocks, particularly a rich, fine-grained, jet black chert, which appears in both the FlQs-30 and GaQs-1 collections and is believed to originate in the Peace River drainage of northwestern Alberta and northeastern British Columbia (P. Donahue, R. LeBlanc, M. Magne, personal communications). Magne (personal communication) informs me that the black chert in question is also very similar to some extremely fine-grained basalts found in central British Columbia.

Silicified siltstone, quartzites, and various mud and siltstones comprise about 34 percent of the lithic assemblage. As at FlQs-30, these are presumed to be primarily of local origin, since all are currently available in the local river gravels, but it cannot be conclusively stated that similar materials were not brought from other sources further away. The one material of known source is the "Glacier Pass" silicified

Table 22. Material type of debitage: GaQs-1.

Material Type	Flakes No. (%)	 Wt. (%)	Shatter No. (%)	 Wt. (%)	Total No. (%)
Quartzite	38(83)	121.9(35.9)	174(11.3)	670 (53.7)	212(10.6)
Vitreous quartzite	8(1.7)	5.1(1.5)	14(0.9)	20.2(1.6)	22(1.1)
Quartz crystal	5(1.1)	0.8(0.2)	87(5.6)	12.3(1.0)	92(4.6)
Chert	283(62.2)	102.4(30.2)	859(55.7)	390 (31.3)	1142(57.1)
Silicified mudstone	30(6.6)	73.6(21.7)	41(2.5)	83.2(6.7)	71(3.5)
Silicified siltstone	63(13.8)	20.0(5.9)	219(14.2)	34.7(2.8)	282(14.1)
Chalcedony	1(0.2)	0.1(0.0)	0		1(0.0)
Silicified sandstone	1(0.2)	80 (2.4)	2(0.1)	11.3(0.9)	3(0.1)
Basalt	0	0	10(0.6)	1.6(0.1)	10(0.5)
Total	455(99.8)	339.4(100)	1543(99.9)	12473 (100)	1998(99.8)

mudstone (Anderson and Reeves 1975) of which 71 pieces, representing 3.5 percent of the debitage assemblage, were recovered. This is approximately half of the percentage noted in the assemblage from the Grande Cache Lake site. Yet, given the prediction from Anderson and Reeves (1975:101-103) that this material should be prominent in the Smoky River valley, one would perhaps expect a higher percentage of this material at the Smoky site. That this was not the case may be a function of the sample size available for study, or it may reflect a genuine paucity of this material in at least parts of the Smoky valley.

Another noteworthy lithic material is the quartz crystal similar to that recovered in small numbers from the Grande Cache Lake site. Ninety-two (4.6%) items of debitage were of this material. As mentioned above, this glass-like pure quartz grows as crystals in caves or caverns and, thus, could come from almost anywhere in the mountain system. Two large, unmodified crystals were recovered from the Smoky site excavations (Figure 85). It is assumed that crystals such as these served as cores for the debitage recovered from the site. One complete artifact - an endscraper - made from this material was recovered (Figure 85). Based on the relatively high number of pure quartz debitage items found at the site, and the recovery of two cores, it appears that a source of these crystals is located in fair proximity to the site.

In contrast to FlQs-30, where 253 pieces of silicified sandstone were recovered, only three specimens of this material were found at GaÇs-1. This is the material which has been said to strongly resemble Beaver River Sandstone. The dramatic difference in the amount of this material at the two sites may indicate a potential source somewhere closer to FlQs-30.

Shatter

Items classed as shatter were counted, weighed and sized with incremental size squares (Table 23). Material type was recorded and the presence or absence of cortex was noted. Of the 1543 items classed as shatter, 75.9 percent are 1 square centimetre or smaller in size, and 98.5 percent of the specimens fall within the three smallest size classes (3 cm^2). By weight, the specimens in these three smallest size classes account for 40.4 percent of the total weight of the shatter collection.

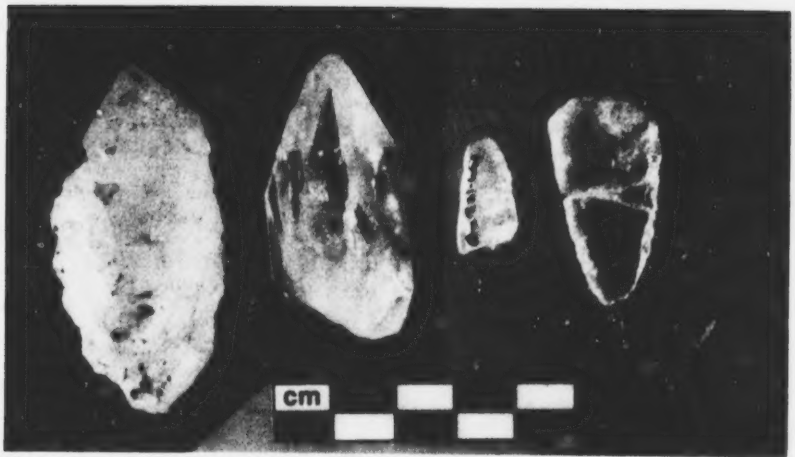

Figure 85. Quartz crystal artifacts recovered from the Smoky site. Cores: a, b; biface fragment: c; endscraper: d.

Examination of the remnant cortex on the shatter specimens revealed that only 11.6 percent retained some evidence of cortex (Table 24). It is noteworthy that the four main raw materials (chert, silicified siltstone, quartzite and mud/siltstone) all have fairly similar percentages of specimens with cortex (range 14.9% to 6.8%; mean 11.3%). These materials are all presumed to be available in the immediate vicinity of the site. In contrast, 39 percent of the glacier pass mudstone specimens still retain some cortex despite the fact that the known source of this material lies some 100 km to the south in Jasper National Park. If this figure is representative of the site assemblage, it calls into question the assumption that cortex will be present less often on raw materials which have travelled considerable distances. The occurrence of materials in bedrock outcrop form as opposed to river or till cobbles may tend to promote retention of cortex even on small pieces from distant sources. The very low percentage of cortex (2.3%) observed on pure quartz items probably reflects the fact that the crystals which form the cores of this material do not seem to acquire the weathering rinds that other materials do, making recognition of cortical pieces very difficult.

In general, the results of examination of the shatter are reminiscent of the FlQs-30 assemblage. That is, shatter pieces are small in size, light in weight, and tend to lack cortex. The evidence again points to

Table 23. Relative numbers and weights of shatter size categories at GaQs-1.

Size Class (cm^2)	No.	%	Total wt. (g)	Avg. wt. (g)
1	1171	75.9	139.9	0.1
2	290	18.8	189.0	0.6
3	59	3.8	174.5	2.9
4	6	0.4	50.7	8.4
5	9	0.6	144.4	16.1
6	4	0.3	123.2	30.8
7	1	0.06	44.7	44.7
8	1	0.06	60.3	60.3
9	0	0	0	-
10	1	0.06	89.7	89.7
11	1	0.06	230.9	230.9

Table 24. Relative frequency of cortex occurrence on debitage from the Smoky site.

Material	No. Shatter	No. w/Cortex	% w/Cortex
Chert	859	100	11.6
Quartzite	174	26	14.9
Silicified mudstone	41	16	39.0
Mud/siltstone	137	16	11.7
Silicified siltstone	219	15	6.8
Vitreous quartzite	14	3	21.4
Quartz crystal	87	2	2.3
Silicified sandstone	2	1	50.0
Basalt	10	0	0
Total	1543	179	11.6

on-site technological activity dominated by tool reduction, resharpening, and the later stages of tool manufacture. Judging from the shatter, primary tool manufacturing was rare at the Smoky site.

Complete (Platform) Flakes

Of the total debitage sample, 455 items (22.7%) are flakes which retain their striking platform. This is considerably higher than the

Grande Cache Lake site assemblage (13.5%). This may reflect the fact that quartzites dominate the FlQs-30 assemblage while cherts dominate the GaQs-1 collection; quartzites may be more prone to result in shatter than cherts.

Similar to the shatter assemblage, chert accounts for most of the flakes (n=283; 62.2%) followed by silicified siltstone (n=63; 13.8%), quartzite (n=38; 8.3%) and silicified mudstone (n=30; 6.6%) (Table 24). Together, these four materials account for 90.9 percent of the flake assemblage. The overall ratio of shatter to flakes is about five to one, compared with six to one at FlQs-30.

Cortex on the dorsal surface of flakes was recorded as being either none, 1 to 49 percent, 50 to 99 percent, or total cortex. The results are as follows:

% Cortex	No. Flakes	%
0	390	85.7
1-49	46	10.1
50-99	16	3.5
100	3	0.6

These figures are nearly identical to those from the FlQs-30 flakes. Again, the overwhelming dominance of flakes completely lacking cortex and the near total absence of flakes with complete dorsal cortex argues strongly for the predominance of tool use and maintenance over tool production activities.

The basic metric dimensions of the platform flakes were individually taken. Broken specimens were omitted from the calculation of mean values given below:

	Length	Width	Thickness	Weight
Range	2.3-64.5	2.2-44.3	0.3-13.5	0.1-26.6g
Mean	11.86	11.27	2.59	0.75g

It can be seen that the flake assemblage is characterized by short, narrow, thin flakes that weigh less than a gram.

In order to gain additional insight into the flake sample, the variables of platform type and number of dorsal scars were examined. The results are nearly identical to those obtained from the FlQs-30 collection. The data again indicate that most GaQs-1 flakes were being struck from the edges of existing tools, as evidenced by the predominance of faceted platforms, and that they were being struck off late in the tool manufacturing sequence, indicated by the presence of three or more scars of previous flakes on over 55 percent of the dorsal surfaces. When these facts are combined with the metric attributes of the flake assemblage, it would appear that the great majority of flakes were being struck from finished or nearly finished tools, primarily as retouching or resharpening flakes derived from bifacially flaked tools.

In general, the debitage consists of flakes and shatter small in size, light in weight, lacking cortex, with multiple scars on the dorsal surfaces and with single or multiple faceted platforms. Shatter outnumbers flakes at a ratio of about 5:1. In all these respects the assemblage is quite similar to that recovered from FlQs-30. Primary site activities, as deduced from the debitage, would appear to be tool maintenance. Primary tool production would appear to be extremely rare at the Smoky site.

Tools

A total of 147 chipped stone tools were identified. As seen in Table 25, over half the formed tools were fabricated from chert. The majority of the remaining tools were made from quartzite, silicified mudstone and silicified siltstone.

Projectile Points

Variability in projectile point form is usually accorded greater significance than that exhibited in other artifact classes, and this is sometimes explicitly attributed to the intentions of the craftsmen (Weissner 1983). These diagnostic, or sensitive, artifacts are often treated in greater detail because of their presumed enhanced information content. While we are not yet fully convinced of the veracity of these presumptions, nevertheless the analysis of points is by and large the language of archaeological studies of small scale hunter/gatherers. Points from any site in this remote area are of interest because the region is so poorly represented in extant literature.

GaQs-1-5: This quartzite artifact is a large stemmed or lanceolate base fragment with rounded basal corners and a straight base (Figure 86h). This may represent an Early Prehistoric specimen, although stemmed

Table 25. Raw material and formed tools, GaQs-1.

	Chert	Sil. Silt	Sil. mud	Qutzit.	Quartz	Fos. chert	Sil. Peat	Total
Projectile Points	1	2	2	3		2		10
Hafted Biface	1							1
Other Bifaces	3	1	1	1	1			7
Endscrapers	10	1	2	2	1	2	1	19
Drills	1			1				2
Pièce Esquillée	1							1
Choppers				1				1
Retouched Flakes	10	3		2				15
Utililized Flakes	32	8	11	6				57
Bipolar Cores	19	2	4	1		1		26
Cores	3		1	1	2			7
Hammerstone				1				1
Total No.	81	16	21	19	4	5	1	147
Total %	55.1	10.9	14.3	12.9	2.7	3.4	0.7	100

lanceolate forms are common during much later periods well north of the study area.

GaQs-1-23: This chert specimen is a poorly made side- or corner-notched point base/blade fragment with obtuse shoulders, fairly deep "V"-shaped notches and rounded acute angled basal corners (Figure 86c). The base is very slightly concave and slightly ground. It is 5.5 mm thick and weighs 4.0 g.

GaQs-1-35: This potlidded chert specimen is a midsection fragment exhibiting one well-executed, acutely angled barbed shoulder and one opposite blade edge portion indicating a generally triangular shape (Figure 86g). The base, tip and opposite shoulder are missing. Barbed shoulders are typical of some Pelican Lake styles recognized on the Plains, but its extreme definition here may more closely resemble some interior B.C. styles of roughly similar age (e.g., Donahue 1977:443).

GaQs-1-160: This is an asymetrical side-notched chert flake point with an elongated triangular blade, obtuse shoulders and deep "V"-shaped

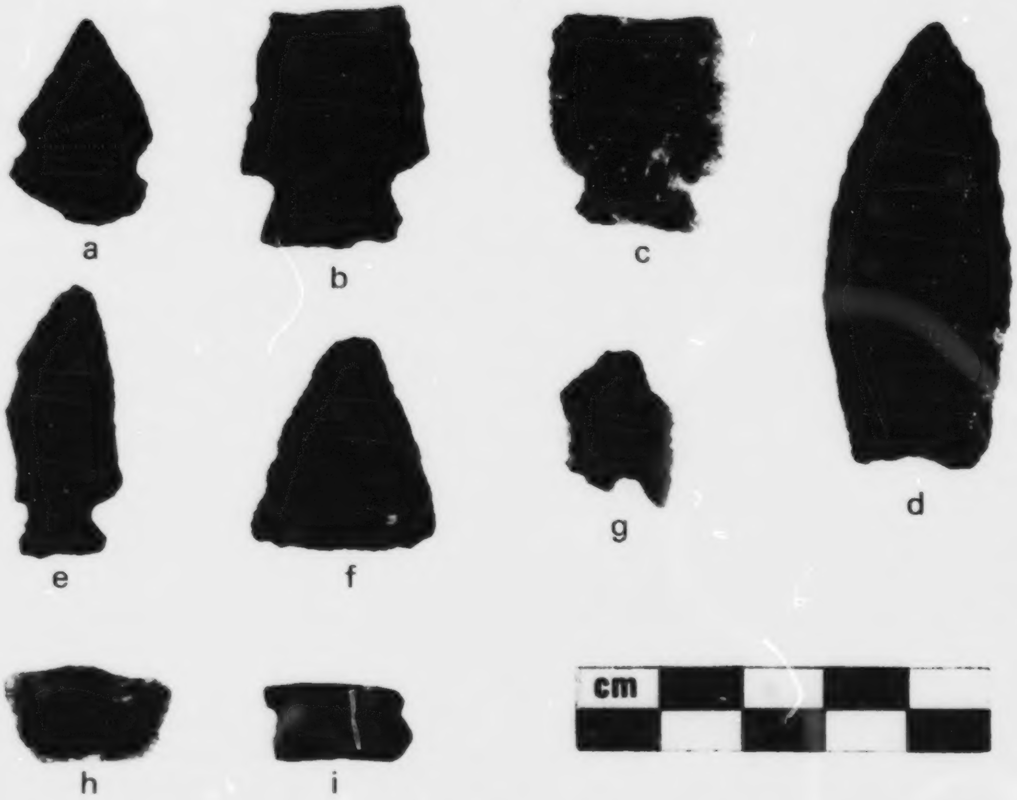

Figure 86. Projectile points from GaQs-1.

notches (Figure 86e). One shoulder is broken. Basal corners are rounded, and the base is ground. This specimen is 4.7 mm thick and weighs 2.2 g.

GaQs-1-301: This quartzite specimen is a complete lanceolate non-stemmed point with excurvate edges and a slightly concave base (Figure 86d). It is 6.6 mm thick and weighs 8.9 g. This specimen is similar to the Agate Basin/Lusk styles of the Plains and southern East Slopes.

GaQs-1-561: This is a large thick corner-notched or stemmed point of silicified mudstone, missing its tip (Figure 86b). It has triangular body shape with straight blade edges, obtuse and acute shoulders and parabolic notches. The basal corners are angular and the base is straight and tightly ground. It is 6.9 mm thick and weighs 4.6 g.

GaQs-1-625: This is an unclassifiable silicified mudstone point base fragment exhibiting shallow side notches, angular basal edges and a straight base (Figure 86i).

GaQs-1-671:

This siltstone artifact is an unclassifiable point blade with possible shallow side notches and acute shoulders (Figure 86f). Its size suggests it may be of Middle Prehistoric age.

GaQs-1-743: This is an unidentifiable quartzite projectile point ear.

GaQs-1-766: This is a small unifacially retouched side-notched flake point of silicified siltstone with a triangular body, shallow parabolic notches and a convex base (Figure 86a). It is 3.1 mm thick and weighs 1.2 g.

Hafted Biface

A single specimen is classed as a hafted biface (Figure 87c). This tool is made from a lusterous, fine grained, brown chert. This biface has been reassembled from several potlid flakes.

This large knife is leaf-shaped with a noticeably pointed tip and shouldering near the base. Blade edges are fairly sharp and show no signs of grinding. Near the base both blades constrict to form the haft element. The base itself is highly convex. On one side of the tip a very highly polished surface may indicate use but more likely a localized patination. This specimen is 9.7 mm thick and weighs 22.7 g.

Other Bifaces

These are represented by six fragments and a preform. One midsecion and an end (Figure 87e and f) are from relatively large tools. The other four fragments, including one of quartz crystal (Figure 85c) are small edge or end fragments. The preform (Figure 87c) is made from a sidestruck pebble chert flake. The lack of either tertiary flaking or use wear suggests this was an unfinished artifact.

Endscrapers

Nineteen unifacially retouched items were identified as endscrapers. These tools are made on thick flakes with the retouched, utilized end of the tool at the distal end of the flake and the haft element at the bulbar end. The distal (or working) end of the tools are slightly curved. Retouching usually continues around the working end onto the lateral sides. However, the proximal (hafted) end of these tools exhibit

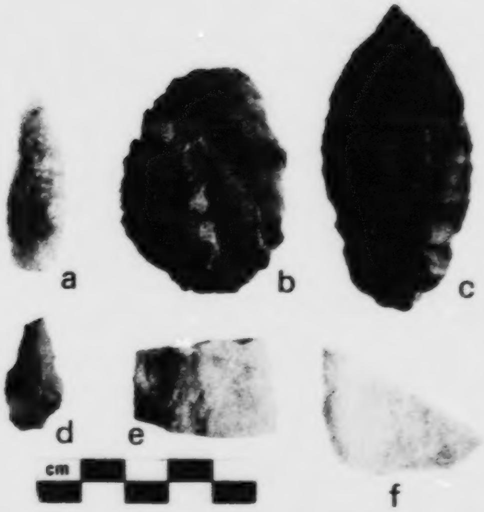

Figure 87. Miscellaneous bifaces from GaQs-1. Drills: a, d; biface preform: b; hafted biface: c; biface fragments: e, f.

smoothed, ground edges presumably indicative of tool hafting. A unique specimen (Figure 85d) is made of a pure quartz crystal which appears almost indistinguishable from glass. Although a number of flakes of this material were found, this specimen was the only tool made of this material.

The majority of these artifacts were recovered from various units placed along the third baseline at the higher, western end of the site. Endscrapers seemed to be clustered in several of the units. In the adjacent units, X-36 and X-40, six unifaces occur within a radius of a metre (Figure 89c). Five more of these were recovered in the 2 square m unit X-45. Finally, in unit 31, three endscrapers and a biface were discovered in what was almost certainly a tool cache (Figure 89b). These tools were found immediately adjacent to each other in an otherwise relatively sterile area of the unit. It is quite possible that these tools were contained in a small bag or pouch.

Drills

Two specimens are classed as drills (Figure 87a and d). The quartzite drill (Figure 87a) is unifacially flaked and is plano-convex in transverse cross section. The blade is somewhat asymetrical being skewed to one side. The tip area is fairly flat and broad. The base is formed by a flat, faceted surface caused by a transverse snap. The chert specimen (Figure 87b) is sloped more in keeping with typical drills, with a narrow pointed tip area and an expanding basal region. The triangular tip is diamond-shaped in transverse cross section. Although much of the base has been removed due to a potlid fracture, it appears to have been ground to facilitate hafting.

Pièces Esquillées

A single dark black chert wedge, or pièce esquillée, was recovered. The raw material of this tool is the rich black chert which is believed to originate from the Peace River country. Flake scars are evident on both faces of the piece originating from every direction and one edge has been both flaked and battered to a fine, straight, sharp edge. No battering is evident on the opposite end.

Choppers

One specimen was identified as a heavy chopping or scraping tool. It is a large quartzite spall with unifacial flaking along part of the dorsal surface. This quartzite spall is the largest artifact recovered from the Smoky site and was almost certainly used for some form of heavy duty chopping or pounding.

Retouched Flakes

Fifteen specimens were identified as retouched flakes. These tools are distinguished from utilized flakes in that they exhibit what is believed to be evidence of intentional retouch as opposed to only evidence of use-wear. Most of these tools are relatively small, thin flakes which exhibit retouch along one edge. Unlike the utilized flakes, the retouched flakes did not show a significant difference in size according to material type; quartzite and mudstone tools were in the same size and weight range as the chert tools. Specimens range from small (less than 3 g, n=8) to quite large (greater than 18 g, n=4). Examination of unit of origin of these artifacts did not reveal any particular pattern or concentration of retouched flakes in any particular part of the site.

Utilized Flakes

The largest category of stone tools from the Smoky site is that of the utilized flake. These tools exhibit one or more of the various forms of edge damage suggestive of tools use rounding, polishing or micro-chipping. The use damage is of such a nature that the tools do not appear to be intentionally retouched.

Metric values indicate these tools are generally very small. Recognition of tools status often required microscopic examination. It is not known how many of these tools may re-fit together, or perhaps more likely, be ultimately derived from larger tools not recovered. The artifacts made of finer rock types were characteristically smaller than those made of quartzite.

Bipolar Cores

A total of 26 items were identified as bipolar cores. The majority are small pebble cores made from thin, oblong chert pebbles collected from the gravels of the Smoky River terraces. All bipolar cores exhibit impact marks and platforms on the opposite ends of the long axis of the pebbles.

Cores

In addition to the bipolar cores already noted, an additional seven cores were recovered. These are generally amorphous in that flakes have been struck from multiple platforms and the cores lack any regularized shape. Two exceptions (Figure 85a and b) are both quartz crystal pieces. Neither specimen appears struck, but it is assumed that crystals such as these must have been the cores for the quartz flakes and the quartz endscraper.

Hammerstone

A single quartzite cobble was recovered which is believed to have functioned as a hammerstone. Evidence of use consists of a small area of pock marks on the thinnest edge of the cobble.

Ground Stone Artifact

A single ground stone artifact was recovered (Figure 88). This unusual specimen is a thick, teardrop-shaped piece of green serpentine

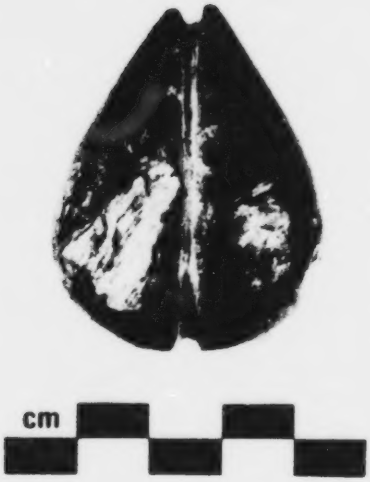

Figure 88. Ground stone artifact from GaQs-1.

which has been carved to form both the overall shape and the groove which completely rings the artifact. The whole surface has been polished smooth, obliterating most of the carving cut marks except those located within the groove and those found on a small unpolished surface. The inside of the groove exhibits long, linear scratch marks presumably caused by a sharp stone flake. It is oval in longitudinal cross section and an elliptical in transverse cross section and is exceptionally symmetrical.

The function of this artifact is unknown, and we know of no other similar tools from any other sites in the region. A netsinker is one possible interpretation, but its light weight (52.1 g) would be unsuitable for the fast, powerful rivers and creeks of the region. Other functions which have been suggested for this artifact include a lake netsinker, an atlatl weight, or a pendant or similar personal adornment.

Lithic Artifact Distribution

As mentioned earlier, all lithic artifacts were individually piece plotted in three dimensions. Due to the lack of vertical separation of the cultural material, plan maps of artifact distribution have illustrated all artifacts found within a single excavation unit.

However, most of the distribution patterns discussed below are likely the result of single technological events.

The wide spacing of units over the site allows only a narrow, unconnected view of the sub-surface structure of the archaeological record. Fortunately, it appears that the nature of the structure is one which permits interpretation even with only a narrow view of the deposits. This is because the patterns observed in many units, especially those placed along the third baseline, are indicative of small scale and highly focussed activity loci which can, in fact, be captured in small area excavations.

Most conspicuous are the tight clusterings of flake concentrations. Clusters of dozens or hundreds of small flakes surrounded by essentially sterile soil were a common feature at this site (see Figure 89). In many cases the flakes in each distinct cluster were of a single raw material suggesting that a single tool or core had been reduced at the site of each cluster. Given the tight spatial clustering of the flakes, and the similarity of raw material types, there can be little doubt that these clusters are the result of individual chipping episodes carried out at a single time by a single person.

Formed tools tend to also be clustered around the flake concentrations. It seems too simplistic and highly coincidental to suggest that tools are being conveniently left where they were being worked on or used. An alternative explanation for the pattern might be that structures had existed at the site which served to concentrate lithic materials in specific places. Also, some ground surface areas may have been covered with skins or mats of brush causing the lithics to cluster in certain spots. A small, historic, native lean-to structure was found at the site in 1975. Such a structure may be similar to ones which may have been employed here in the past.

Finally, as previously mentioned, a tight cluster of tools (probably a cache) was found in the northeast corner of unit 31 (Figure 89b). This cluster of tools is composed of three endscrapers, a biface and a retouched/utilized flake which were found immediately beside each other and must have been deposited at one time. Perhaps a small pouch of tools was placed here and never reclaimed.

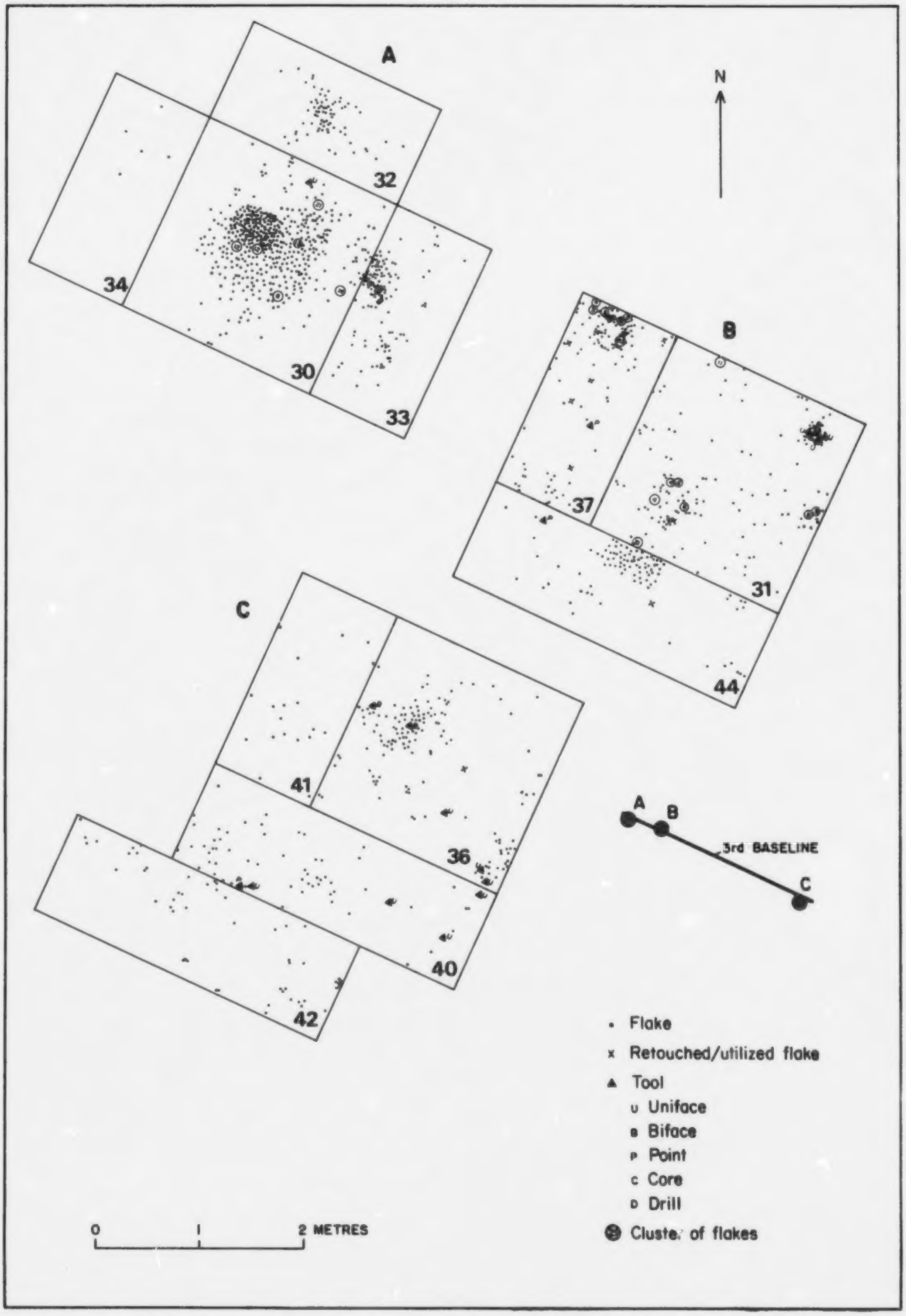
A
N
32
34
30
33
B
37
31
44
C
41
36
40
42
A
B
3rd BASELINE
C
• Flake
x Retouched/utilized flake
▲ Tool
U Uniface
B Biface
P Point
C Core
D Drill
⊕ Cluster of flakes
0
1
2 METRES

Figure 89. Artifact clustering in three of the excavation areas at the Smoky site.

Little else of a definitive - or even suggestive - nature can be said about the lithic distributions seen in these widely scattered units. Without the excavation of a fairly large contiguous area, it will be difficult to know if inferences of specific individual working areas and possibly of the presence of structures, are representative of the site as a whole.

Faunal Remains

Faunal remains were recovered from all areas of the site and in all excavation units of 1 square metre or larger. These remains are characterized by small, fragile fragments of calcined or charred bone, most of which are roughly rectangular in shape and typically weigh a gram or two. Faunal specimens typically occurred in pockets or concentrations without evidence of features. The perimeters of these concentrations were recorded on the floor plan maps.

Like FlQs-30, the fragmentary nature of the GaQs-1 fauna may be due to cultural processing or to natural taphonomic breakdown. The fact that no obvious hearth stains, boiling pit features or other contextural evidence of site activity were found with the bone fragments means that a conclusive determination of cultural processing vs natural breakdown must remain equivocal.

Because of the size and condition of the faunal remains, the vast bulk of the bone can only be said to be from medium to large sized mammals, and the majority of fragments appear to be from the major limb bones. Of the 8,406 individual bones, only nineteen could be identified to a particular species: Lepus americanus (snowshoe hare), Ovis canadensis (bighorn sheep), Castor canadensis (beaver), Cervus elaphus (elk), and Alces alces (moose). Other species only tentatively identified include goat, lynx and porcupine. A number of bones were identified as a small cervid, a large rodent and a small ungulate. No bird or fish remains were recovered.

Given the great number of fragments identified as large mammal, it is suggested that moose and elk were the most important animal foods for the inhabitants of the site. Assuming that the excellent eating fish currently available in the Smoky River were also available in the past, this resource was probably utilized. The absence of fish remains is likely a result of adverse preservation factors.

Features

Unfortunately, no definite features were recorded at GaQs-1. The occasional faint stain in the soil was noted, but many of these are believed to be the result of old tree-throws uprooting a section of soil. No obvious alignments of unmodified rocks were noted. Likewise, no concentrations of fire-broken rock were observed; in fact FBR was exceedingly rare at the site. No obvious hearths or pits were excavated. Fires may have been simple surface fires not employing rock lining or rock rings and not excavated into the sub-surface soils. The only remains of such a simple fire may be an oxidized stain, which may be difficult to detect in the reddish-brown loess.

If our evidence is dependable, the general lack of features at the site may suggest that occupation here was short-term and for purposes which did not require activities normally associated with archaeological features. That is, perhaps little in the way of animal carcass processing and food preparation transpired at this site. If used as a campsite, such camping events may have been very short in duration. The highly localized nature of the lithic distribution would support these interpretations. One would expect longer encampment to ultimately result in more dispersal of material culture. Thus it would appear that GaQs-1 may have functioned primarily as a transitory camp, where game in the river valley could be observed, tools repaired, small meals consumed, temporary shelters erected, and brief overnight stays by small groups of people transpired.

DISCUSSION AND CONCLUSION

Given the paucity of archaeological work conducted in the northern Alberta/British Columbia Rocky Mountain system, it is currently impossible to posit firm schemes of local culture history or culture process. Yet the work reported on here, plus the few studies of adjacent regions, permit some initial speculations.

The purpose of our work in the Grande Cache region was to find and examine prehistoric sites in order to begin building a data base for this area of the province. In terms of site discovery, this meant giving survey priority to those areas where experience had indicated prehistoric sites were likely to be found. This biased and judgemental coverage is of little utility in reconstructing aboriginal settlement patterns for the area as a whole. Little or nothing is known of prehistoric settlement away from the major rivers and lakes. The discovery of sites FlQs-20, 21 and 22 on minor breaks in slope of an otherwise steep hillside on the lake, and of FlQs-17 in a nondescript forested area several hundred metres away from the north bank of the Sulphur River, give evidence of complexities to a settlement pattern which are as yet not understood. Still, studies in similar environmental regions of northeastern B.C. which have employed systematic site survey strategies (Ball 1980; Spurling 1980) appear to support the general assumption that sites will typically be found in close proximity to major water sources. Given the topographic and climatic extremes of the mountains, we suspect that future research in these areas will continue to confirm the preference of prehistoric hunters for settlement along lake shores and river and creek margins. Yet deviations from this pattern occurred, and the explanation of these anomalies promises to shed some interesting light on the range of cultural activities which transpired over the region as a whole. Such explanations will require research strategies vastly different from our own and will, of necessity, include the search for and excavation of sites away from water sources.

Prehistoric sites discovered in the Grande Cache region of the Alberta Rockies tend to be small in spatial extent and composed of low amounts of cultural material. These characteristics were especially true of sites discovered along the terrace edges of major river valleys and at less favourable locales on lake shores (i.e., low lying, non-level and non-south facing). The largest and most productive sites were those situated on level, well-drained, elevated benches on the north side of lakes. It is suspected that the latter pattern can best be explained by proposing that such site locations were ideal winter campsites where occupancy may have lasted several months and resulted in the accumulation of large amounts of cultural material. The prime advantage of a semi-sedentary lake shore winter campsite is the presence of a relatively dependable, captive food supply - lake fish. Boreal forest dwellers have been known to camp for extended periods in winter at good fish lakes (see Ives 1985; McCullough 1982; Ridington 1968). Given the difficulties of travel and hunting during the winter in the mountains, and the relatively dispersed and solitary nature of the major game species (moose, elk, deer, sheep), the choice of lake shore campsites would seem an effective hedge against hunting failure and starvation.

On the other hand, the lack of prehistoric sites on the margins of Ptarmigan Lake serve to remind us that not just any lake will automatically attract winter habitation. Ptarmigan Lake lacked the level, well-drained, elevated benches which were found on Grande Cache Lake. Ptarmigan Lake is situated in a high, sub-alpine environment which may have discouraged winter occupation, and it is not clear whether or not fish would have been a stable, predictable resource in this lake. Careful pre-field analysis of the environmental setting of different lakes in the region should permit the delineation of those most suitable lakes for occupation.

Aspect emerges as an important factor in site locations for both lake and river margins. Although most of our survey focussed exclusively on the north banks of rivers and creeks, limited testing of south banks - combined with the complete coverage of the margins of Grande Cache Lake - argue strongly for a preference for south-facing site locations. Given the height of surrounding hills and mountains and the thick forest cover which blankets the region, the increased solar radiation in a clearing on a south-facing terrace is immediately apparent to the casual visitor.

Our limited data suggests that sites situated along terraces of rivers and creeks tend to be quite small in spatial extent and extremely limited in cultural material, especially when compared with lake shore sites situated in favourable settings. Typically, river and creek terrace sites consist of low densities and low frequencies of lithic and faunal remains, and these remains tend to be clustered into small, separate groupings. Thus, at most sites excavations all around a test pit which had yielded a few flakes and some bone scraps would generally fail to recover additional material. Even at a larger, more intensively used river terrace site, such as the Smoky site which is situated at the junction of two prominent rivers, the faunal and lithic distribution maps are consistent with this highly localized distribution pattern. It is believed that most of the spatial arrangements are a result of short-term residency by small groups of people and from single individual work episodes. Many of these sites are likely the product of very short-term stops (i.e., transitory camps) along important travel routes. The apparent paucity of faunal material, features and fire-broken rock at most of these sites supports this contention, as does the nature of the lithic remains. With few exceptions, the lithic assemblage is dominated by small flakes derived from tool completion and resharpening. Evidence for primary and, to a lesser extent, secondary lithic workmanship is relatively minor. To a large extent, this same observation is true of the larger, richer lake shore sites.

Although the sample is indeed small, our data also suggest that many small sites will be found on the banks of small creeks which are tributaries to the major rivers. A good example of this is apparent from our survey of the small unnamed creek northwest of Adolphus Creek where six prehistoric sites were located. Sites were situated on both sides of the creek at level areas where there was a noticeable break-in-slope interrupting the drop of land towards the Sulphur River. Presumably, these sites too are the by-product of short, transitory camps resulting from travel through this area. There was no noticeable difference between the artifactual remains found at the creek bank sites and those found at the river bank sites.

Obviously, comments on subsistence of the prehistoric hunter/gatherers are hampered by the derth of organic remains preserved at these sites. That large- and medium-sized mammals were hunted, butchered and consumed at many of the Grande Cache sites is evidenced by the meager faunal remains. A firm characteristic of regional prehistoric sites is the poor condition of bone. Virtually without exception, faunal material was found in highly fragmentary condition reducing species identification to near zero. As mentioned above, it is not clear whether the fragmentation is a result of cultural processing or natural taphonomic processes. Quite likely, both processes were at work at many sites. It seems reasonable to propose that a wide range of mammals were hunted and trapped; the most important were possibly moose, sheep, elk and deer. The importance of small mammals in the prehistoric diet remains a mystery. Likewise, the role of fish as a food source is unknown. Fine screening would need to be employed to help address these issues.

Seasonality of site occupation in the region is not deducible except through inference. As mentioned, an argument can be made that the larger, richer lake shore sites are likely winter camps. Conversely, the very small river terrace sites may well be summer camps. Neither type of site need exclusively have been used in these seasons, however; no data was recovered from any site which would permit determination of seasonality.

Lithic material types appear to be primarily of local to regional origin. However, this conclusion is tempered by a lack of information on the sources of many materials. Most of the cherts and quartzites are believed to originate from the river gravels and till deposits. These two rock types comprise the bulk of the lithics for all sites discovered in the Grande Cache region. Most of the silicified sand, silt and mudstones are also believed to be from regional sources. The one known source is a quarry quarry of silicified mudstone situated in northern Jasper National Park in the upper reaches of the Snake Indian River drainage basin (Anderson and Reeves 1975). Material from this quarry - "Glacier Pass" - does appear in modest amounts in the sites of the Grande cache region, but perhaps not in the quantity Anderson and Reeves (1975:103) predicted. A few specimens of raw materials known to have travelled considerable distances are present and include Knife River Flint, Banff Chert (silicified siltstone), Anahim Peak obsidian and possibly Beaver River Sandstone.

A final note on raw material types should mention the presence of a rich, glossy, black chert in the Grande Cache assemblage. Though not a dominant type of chert at these sites, we did recover flakes, flake tools, points (Figures 68a and 73h), endscrapers and other artifacts made of this material. The Clovis point recovered from the Smoky site by Bonnichsen was also described as having been made of a glossy, black chert (Bonnichsen, personal communication 1975).

It would appear that this material is characteristic of prehistoric assemblages in the northern Alberta and British Columbia Rocky Mountains. At the Charlie Lake Cave site near Fort St. John, the majority of artifacts made from this stratified site are made from a glossy, black chert (Fladmark et al. 1984:105). The great antiquity of the utilization of this material is confirmed by the association of black chert flakes with a fluted point in the lowest level of Charlie Lake Cave, dated at 10,500 years B.P. (Fladmark et al. 1984:82). The source of high quality cherts is not known, but Fladmark et al. (1984:108) suggest that the general lack of cortex and the intensive reworking and resharpening of tools and flakes made from this material indicate a non-local origin.

Spurling's study of the Peace River in northeastern B.C. also notes the presence of flakes and tools made a "very fine, flawless black chert" (1980:174). This high quality material apparently differs from the dominant lithic material of the region which Spurling (1980:325) describes as chert cobbles obtained locally from fluvial gravel deposits. Artifacts made of this latter material type are deduced as being local, based on the high incidence of core fragments which exhibit cortex (Spurling 1980). In contrast, the high quality black cherts are suspected to be exotic to northeastern B.C. (Spurling 1980).

Black chert was also the dominant raw material recovered from excavation at GiRi-4, a prehistoric site on Gwillim Lake in northeastern B.C. (Ball 1978:83). Ball describes this material as having waxy lustre and good flaking properties but also notes the presence of fine grey or light coloured bands and occasional inclusions in the rock. This raises some doubt as to whether or not the black cherts from Gwillim Lake are similar to the high quality black cherts recovered from other areas of the northern Rockies.

On the Alberta side of the northern mountains, rich, black cherts were the dominant material recovered from the Karpinski site near Grande Prairie (Bryan and Conaty 1975). At the Tukwakin site, located on the shores of Musreau Lake some 90 km northeast of Grande Cache, black cherts were common in the mixed Middle Prehistoric assemblages (Buchner 1978). Thompson (1973) remarks on the presence of black cherts in northwestern Alberta, and Anderson and Reeves (1975) document the occurrence of both vitreous and dull, black cherts in the Jasper Park area. The source or sources of black chert are unknown. Thompson (1973:46) mentions rumored sources in the Liard drainage and near the confluence of the Peace and Red rivers. For the moment, it would seem that high quality black chert is common in archaeological assemblages in northwestern Alberta and northeastern B.C., but becomes less frequent at sites further south in the mountain system.

An interesting discovery in the Grande Cache region has been evidence of microblade technology. One complete obsidian microblade and several microblade fragments were recovered from sites on Grande Cache Lake. No portions of microblade cores were recovered. Chert microblades have also been recovered from a site (FiQk-4) just outside the east boundary of Jasper Park (Anderson and Reeves 1975:121-123). This site lies on a bench above a small creek which flows into the Athabasca River. It may be noteworthy that site FiQk-4 contained flakes (not microblades) of obsidian which were sourced as coming from Anahim Peak in British Columbia, the same presumed source as the obsidian microblade from FlQs-27. Thus, there is a suggestion of a small but detectable use of microblade technology in the northern Alberta Rockies, and one that may be unique to the Alberta mountain system. Furthermore, some connection between this technology and interior British Columbia is suggested by the presence of B.C. obsidian at two sites which contain microblades. However, the lack of cores at any sites in the northern Rockies casts doubt upon whether a real microblade industry (i.e., manufacturing) was ever present, or whether a few specimens have been traded in over the years.

Faint evidence of microblades in the northern Alberta Rockies appears to be a trait shared with adjacent regions of northeastern British Columbia. Spurling's (1980) survey of section of the upper Peace River drainage recovered a few specimens identified as microblades. Simlarly, Fladmark's excavations at the Charlie Lake cave site, located a few kilometres north of the Peace River near Fort St. John, resulted in the recovery of a single microblade midsection (Fladmark et al. 1984:88). The Charlie Lake specimen was recovered from component 6, which was dated to approximately 5,500 to 4,300 years before present. This microblade is described as being made from a distinctive blue-grey chert with small white specks or mottles (Fladmark et al. 1984:88). This description fits our recollection - albeit based on personal inspection many years ago - of the chert microblades collected from FlQk-4, the site in the Athabasca Valley east of Jasper Park.

As was the case in the Grande Cache region, microblade cores appear to be much more rare in northeastern British Columbia than do microblades themselves. To our knowledge, only one specimen has been recorded, this by Fladmark et al. (1975:87) in the course of site survey in the upper Peace River region. Indeed, there may be some question regarding the accuracy of the artifact identification, as Fladmark et al. (1975:87) refer to the item as a "possible microblade core." Regardless, given our current knowledge, it seems safe to conclude that microblade cores are conspicuous by their absence in the drainage basins of the Athabasca, Smoky and Peace rivers. This again raises the possibility that the microblades were traded into this mountainous region, rather than arguing for a resident microblade technology.

It may be noteworthy that obsidian flakes associated with the chert microblades at site FiQk-4, as well as all obsidian so far sourced from archaeological studies in the Grande Cache region, have been identified as coming from the Anahim Peak source. In contrast, all obsidian sourced to date from the upper Peace River and adjacent areas has been traced to the Mt. Edziza sources in far northwestern British Columbia (Ball 1978:86; Fladmark et al. 1984:85; Spurling 1980:328). Thus, there would seem to be some evidence to support the idea that the prehistoric inhabitants of the northern Alberta Rockies participated in a trade and possibly travel network oriented to the southwest, whereas residents of the B.C. mountain system may have preferred contacts aligned to the northwest. This tidy arrangement of the obsidian source data has recently been complicated by the identification of obsidian found at prehistoric sites in Jasper Park as originating from both Anahim and Edziza sources (James, this volume). Clearly, spheres of influence and zones of interaction are not yet understood.

Utilizing archaeological data from the Grande Cache region to construct a cultural historical framework is severely hampered by the lack of temporal control over artifact assemblages, a lack of stratified or demonstrably single component sites, and by the paucity of diagnostic artifacts. None of the radiocarbon dates currently available from the Grande Cache area can be confidently applied to a specific set of artifacts. Rather, the dates provide only the general indication that sites in the area have been occupied between about 5,000 and 1500 years ago. Beyond this, we must look to formal attributes of projectile points to provide tentative indications of time and space relationships. For example, the recovery of a Clovis style point from the Smoky site suggests but does not confirm the occupation of the area in Paleo-Indian times, perhaps 10-11,000 years ago.

This approach relies on the general veracity of typological comparisons over great distances. Risky at the best of times, our embryonic knowledge of the archaeological record of the northern mountain system is cause for extreme caution in making widespread and sweeping artifact comparisons. As evident from our projectile point descriptions, we have adopted a conservative stance in postulating possible cultural connections between our data and that from better studied regions possessing more firmly established culture history sequences. The great majority of points from the Grande Cache study have not been assigned any typological classification. Where typological affinities have been suggested, they employ categories established for the northwestern Plains. This is inevitable in that the latter region remains the best documented culture area within striking distance of the northern Alberta mountains (see Frison 1978; Reeves 1983; Vickers 1986).

Indeed, virtually all previous work in the northern Rockies has employed the Plains point typology to various regional data. Based on limited survey, excavation and examination of private collections Spurling (1980) and Ball (1978, 1980) argue for the presence in northeastern B.C. of a full range of Early, Middle and Late Prehistoric Period point types. These include possible fluted points, Agate Basin, Eden/Cody material, Lusk/Frederick, Salmon River, Oxbow, McKean, Pelican Lake, Besant, Avonlea and Prairie/Plains Side Notched. A similar sequence, based on survey and private collections, is postulated by Anderson and Reeves (1975) for the Jasper Park area. From the nearest excavated site to the Grande Cache region - the Tukwakin site on Musreau Lake - Buchner (1978) reports the presence of Middle Prehistoric point types. His material, consisting of twelve analyzable specimens, are said to resemble Oxbow, McKean, and possibly Pelican Lake and Besant points. The original discoverers of the site (Slater 1976) recovered one point which they claimed showed relationships to the Taltheilei Shale tradition of the Northwest Territories. Other artifacts from the Tukwakin site include flake knives, point blanks, endscrapers, hammerstones, axes and adzes. Five features were recorded, all presumed to be hearths, consisting of charcoal, burnt bone and fire-broken rocks. Faunal material was badly shattered and generally scarce. Identified species included beaver, deer, elk, hare and lynx (Buchner 1978). No evidence is reported which supports occupation of the Tukwakin site during the Early or Late Prehistoric periods.

The Tukwakin site compares favourably with both the Smoky and especially the Grande Cache Lake sites. Both the condition and identified species of faunal material are similar to Grande Cache fauna. Features and lithic artifacts also seem to be generally similar. The dominance of Middle Prehistoric point types at both Musreau Lake and Grande Cache is also noted. Except for the elusive Clovis point from the Smoky site, and the possible Paleo-Indian point base from FlQs-27 (Figure 68a), no evidence of Early Prehistoric material was recovered from our work in the Grande Cache region. We have also observed the apparent lack of point styles which can confidently be assigned to the Late Prehistoric Period. This observation must be tempered by the recognition that most of the points from the Grande Cache region cannot be readily compared with established types, hence their approximate age and culture affiliation remains unknown. What can be said is that no clear examples of northern Plains point styles attributed to the Late Prehistoric Period have yet been recovered in the Grande Cache region.

This preliminary synthesis of archaeological data from the northern portion of the Alberta Rocky Mountains is clearly only the beginning of our understanding of culture history and culture process in this area. Although the data reported here represent four field seasons of archaeological activity, we are still a long way from appreciating the range and nature of the data base itself, let alone the human behaviors which produced it. Advancing our knowledge of the prehistoric inhabitants of this rugged and remote landscape promises to be as difficult and demanding as the country in which the information lies.

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LATE QUATERNARY VEGETATION
AND CLIMATE OF THE EASTERN SLOPES
- THE RECORD FROM POLLEN STUDIES

By

Robert E. Vance

INTRODUCTION

The mountains and foothills of the Eastern Slopes of the Rocky Mountains occupy the southwestern border area of Alberta. Although this region is extensively forested today, recent palynological studies indicate that its vegetation has varied in the past, particularly in early post-glacial time. The purpose of this paper is to review palynological research conducted in the Eastern Slopes and to formulate a preliminary model of Holocene vegetational development for the region.

Variations in aspect, slope and altitude in the Eastern Slopes produce a present-day vegetational mosaic varying from mixed deciduous-coniferous forests in river valleys to alpine tundra on mountain peaks. However, a vast majority of the area is dominated by coniferous forest. The principal species of this forest canopy are lodgepole pine (*Pinus contorta* var. *latifolia*) and white spruce (*Picea glauca*). Douglas fir (*Pseudotsuga menziesii*) is a major component of the southern reaches of the Eastern Slopes forest. Other tree species commonly found in the study area include Engelmann spruce (*Picea engelmannii*), alpine fir (*Abies lasiocarpa*), black spruce (*Picea mariana*), white birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*). Limber pine (*Pinus flexilis*) is prevalent on exposed rocky slopes only in the extreme southern portion of the Eastern Slopes.

The climate of the area today is extremely variable (due to altitudinal variation), and meteorological records are limited. Generally, the mid-altitude forested area has a continental type of climate, characterized by cool, short summers (Longley 1967) similar to northern Alberta but not exhibiting the same degree of seasonality. This is because in winter cold Arctic air does not regularly extend to higher altitudes, while in summer the higher altitudes have slightly lower maximum temperatures. For the period 1951 to 1960, July temperatures averaged about 14°C and the total annual precipitation in the Eastern Slopes region was about 50 cm (Longley 1967).

PALYNOLOGICAL RESEARCH

Only radiocarbon dated palynological studies in the Eastern Slopes area are considered in this report. Figure 90 shows the locations. Table 26 lists the study locations, researcher(s) responsible for the work, the status of the work, and relevant references (if available).

The earliest records of vegetational change in Alberta come from the Eastern Slopes. This is not unexpected since this region lies within the limits of the ice-free corridor (Rutter 1980). The earliest radiocarbon date comes from Chalmers Bog. The pollen stratigraphy of this site provides insight into early post-glacial vegetation of the Eastern Slopes and hints at possible vegetational characteristics of the ice-free corridor.

The earliest pollen assemblage at Chalmers Bog (Figure 91) is dominated by non-arboreal types, namely grass (Gramineae), sage (Artemisia) and sedge (Cyperaceae). Plantain (Plantago) regularly appears as a minor element. Willow (Salix) is the only shrub consistently represented. Poplar (Populus) is the only tree taxon recorded in amounts indicative of a local presence, but values are low, suggesting that it likely appeared only in scattered groves.

Mott and Jackson (1982) interpret this pollen assemblage as a tundra-like setting. It was established at the site 18,000 years B.P. (radiocarbon years before the present) and existed for a considerable period of time. Unfortunately, the duration of its existence is impossible to determine since this portion of the sediment core is marly and unsuitable for radiocarbon dating. Furthermore, numerous changes in sediment lithology indicate that simple interpolation from other radiocarbon dates would result in inaccurate age estimates.

Sometime prior to 8,200 years B.P. (the next dateable portion of the core), forest conditions were established near Chalmers Bog. Elements of this forest canopy included pine (Pinus) and birch (Betula). Low pollen influx during the early stages of forestation indicate that either

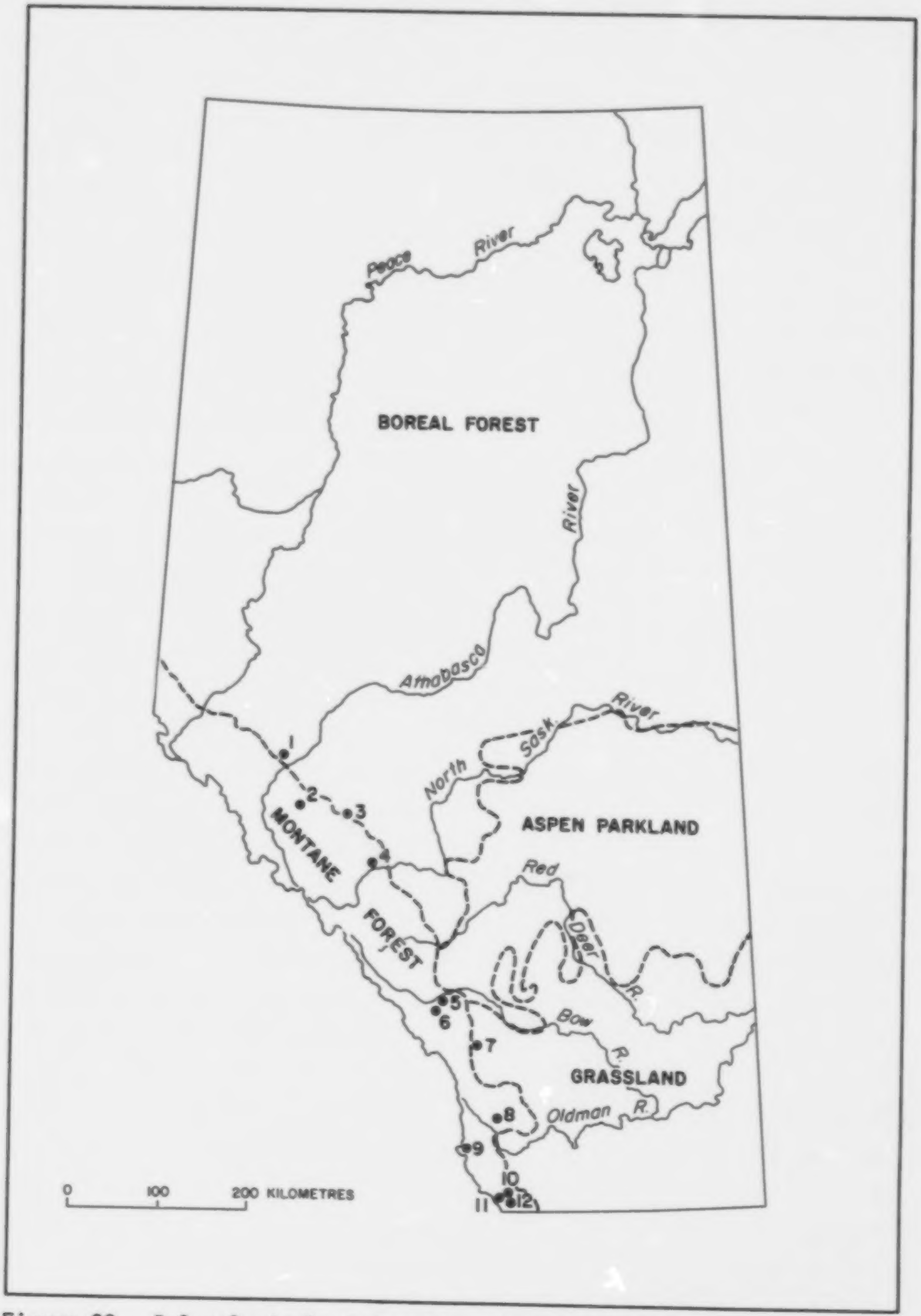
Peace River
BOREAL FOREST
Athabasca River
North Sask. River
ASPEN PARKLAND
Red Deer R.
MONTANE FOREST
Bow R.
GRASSLAND
Oldman R.
1
2
3
4
5
6
7
8
9
10
11
12
0 100 200 KILOMETRES

Figure 90. Palynological study sites, Eastern Slopes region of Alberta.

Table 26. Study sites and reports, Eastern Slopes region of Alberta.

1.	Gregg Lake	C. Schweger and T. Habgood; work in progress
2.	Mary Gregg Lake	Bombin, E.R. (1982)
3.	Fairfax Lake	Schweger, C.E., T. Habgood, and M. Hickman (1981)
4.	Goldeye Lake	C. Schweger, M. Hickman, and T. Habgood, work in progress
5.	Yamnuska Bog	MacDonald, G.M. (1982)
6.	Wedge Lake	MacDonald, G.M. (1982)
7.	Chalmers Bog	Mott, R.J., and L.E. Jackson (1982)
8.	Callum Bog	Alley, N.A. (1972)
9.	Crowsnest Lake	Driver, J.C. (1978)
10.	Goat Lake	Bujak, C.A. (1974)
11.	Lost Lake	Bujak, C.A. (1974)
12.	Linnet Lake	Christensen, O.A., and L.V. Hills (1971)

arboreal pollen was being transported from forests some distance away or the forest canopy at the site was sparse and discontinuous. By 8,200 years B.P., an abrupt rise in pollen influx combined with a drop in non-arboreal pollen representation (mainly sage) signals the establishment of forest conditions around the site similar to those existing today. With the exception of a slight increase in herbaceous taxa directly above the Mazama ash layer (deposited 6,600 years B.P.), little vegetational change is evident from 8,200 years B.P. to the present.

MacDonald (1982) analyzed sediments from two study sites located in the Kananaskis Valley, slightly north and west of Chalmers Bog. The earliest sediments from Yamnuska Bog (Figure 92) contain a pollen spectrum very reminiscent of the early non-arboreal pollen zone at Chalmers Bog, although Yamnuska Bog contains larger amounts of juniper (_Juniperus_), buffalo-berry (_Shepherdia canadensis_), chenopods (_Chenopodineae_) and poplar. Pine and spruce are consistently represented but by values too

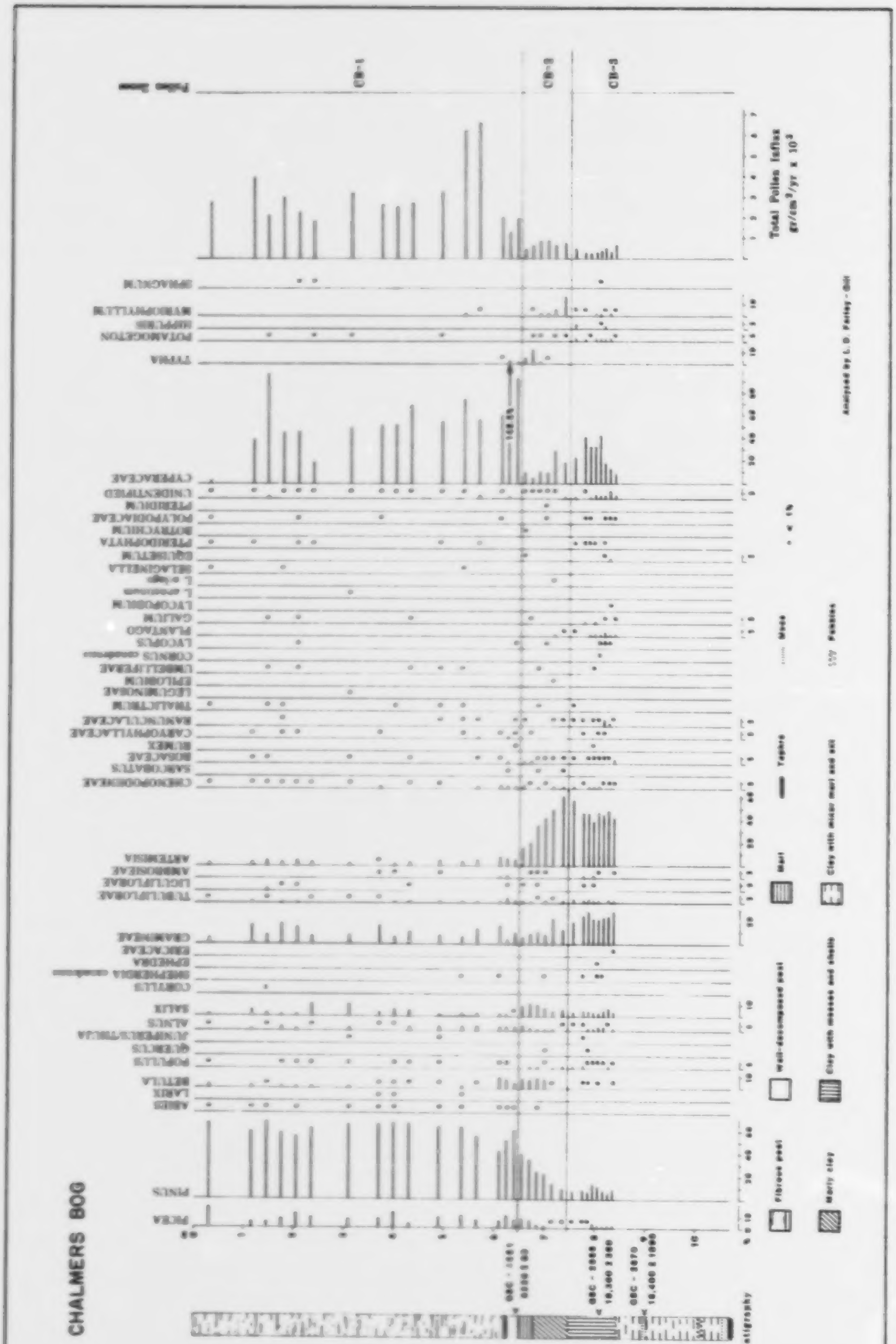

Figure 91. Chalmers Bog relative percentage pollen diagram (reproduced with permission of R.J. Mott).

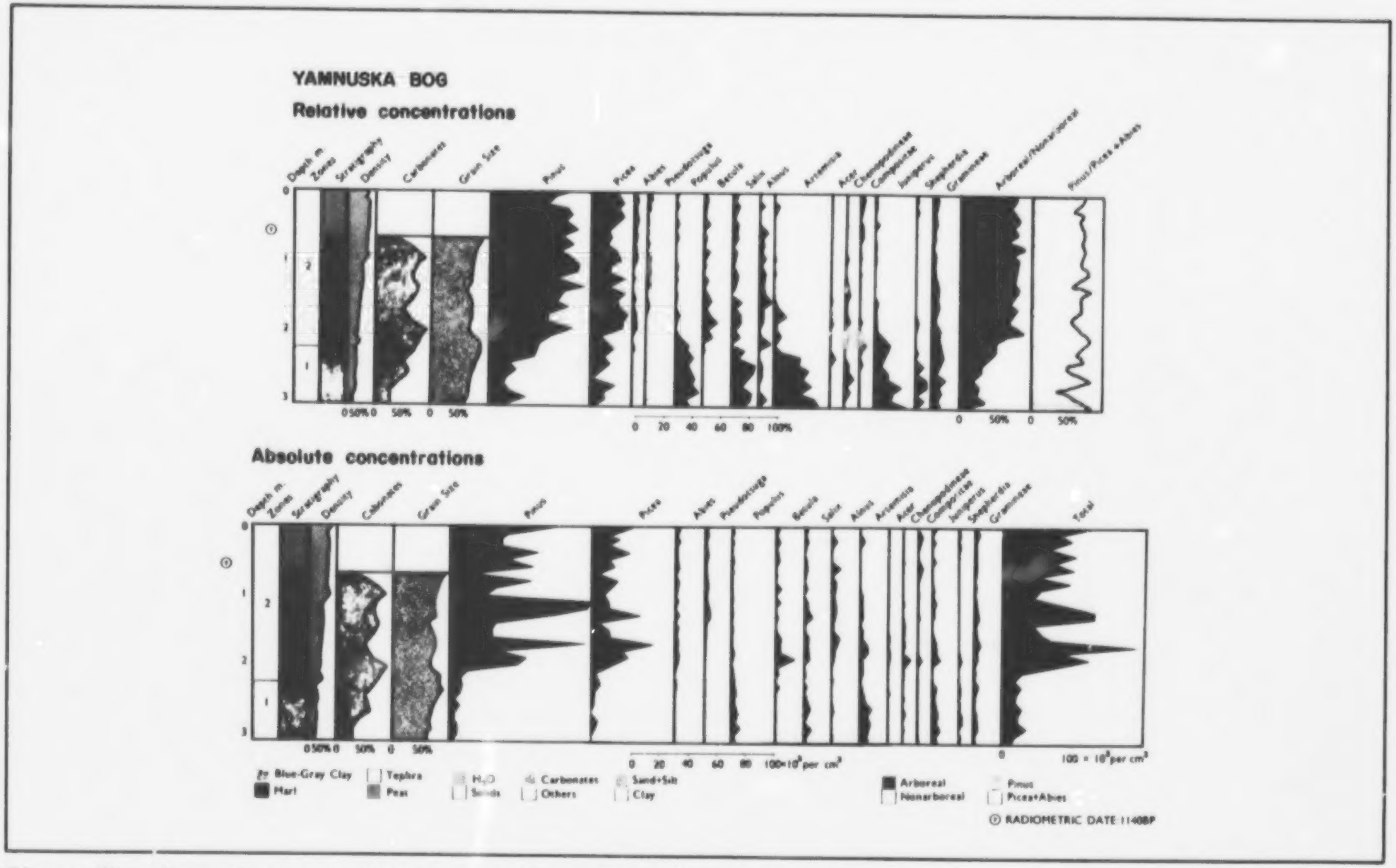

Figure 92. Yamnuska Bog relative percentage and pollen influx diagrams (reproduced with permission of G.M. MacDonald).

low for them to be considered members of the local vegetation. These minor differences do not alter the general interpretation of the pollen spectrum, however, since the low pollen influx and low arboreal pollen representation combined with high sage and grass percentages are indicative of a sparsely treed terrain. MacDonald interprets this assemblage as a tundra type of environment.

Due to marly sediments in the lower portion of the core, the timing of early events at Yamnuska Bog is uncertain. However, nearby Wedge Lake (Figure 93) does not contain evidence of non-arboreal conditions, and its basal sediments have been dated to 10,400 years B.P., suggesting an earlier date for non-arboreal conditions at Yamnuska Bog. The pollen stratigraphy from Wedge Lake indicates mixed-wood forest conditions were established about 10,000 years B.P. A similar date may be inferred for this event at Yamnuska Bog. From 10,000 years B.P. to the present, little vegetational change is indicated at either site. However, MacDonald suggests that the frequency of pine relative to spruce plus fir in the two records indicates an extended period of increased fire frequency from early to mid-Holocene time that peaks just prior to the Mazama ash fall.

Palynological evidence from Fairfax Lake (Figure 94), located in the northern portion of the Eastern Slopes region, documents an early post-glacial transition from non-arboreal to arboreal vegetation (Schweger et al. 1981), similar to events in the more southerly study sites already discussed. Prior to 11,000 years B.P., the pollen spectrum is dominated by willow, sage, grass and sedge. Other herbs noted to have a minor but regular occurrence in the basal sediments include composites (Compositae, high spine type), plantain and chenopods (Habgood, personal communication 1983), taxa commonly found today in grassland settings. Poplar and birch are present but are represented consistently only in the upper half of this assemblage. Pine and spruce are poorly represented except for abrupt peaks near the base of the core; these are most likely redeposited pre-Quaternary grains since detrital coal was discovered in these sediments (Schweger et al. 1981). This pollen spectrum is interpreted by the authors as a treeless tundra-like environment. It is very similar to the basal non-arboreal zones in Chalmers Bog and Yamnuska Bog.

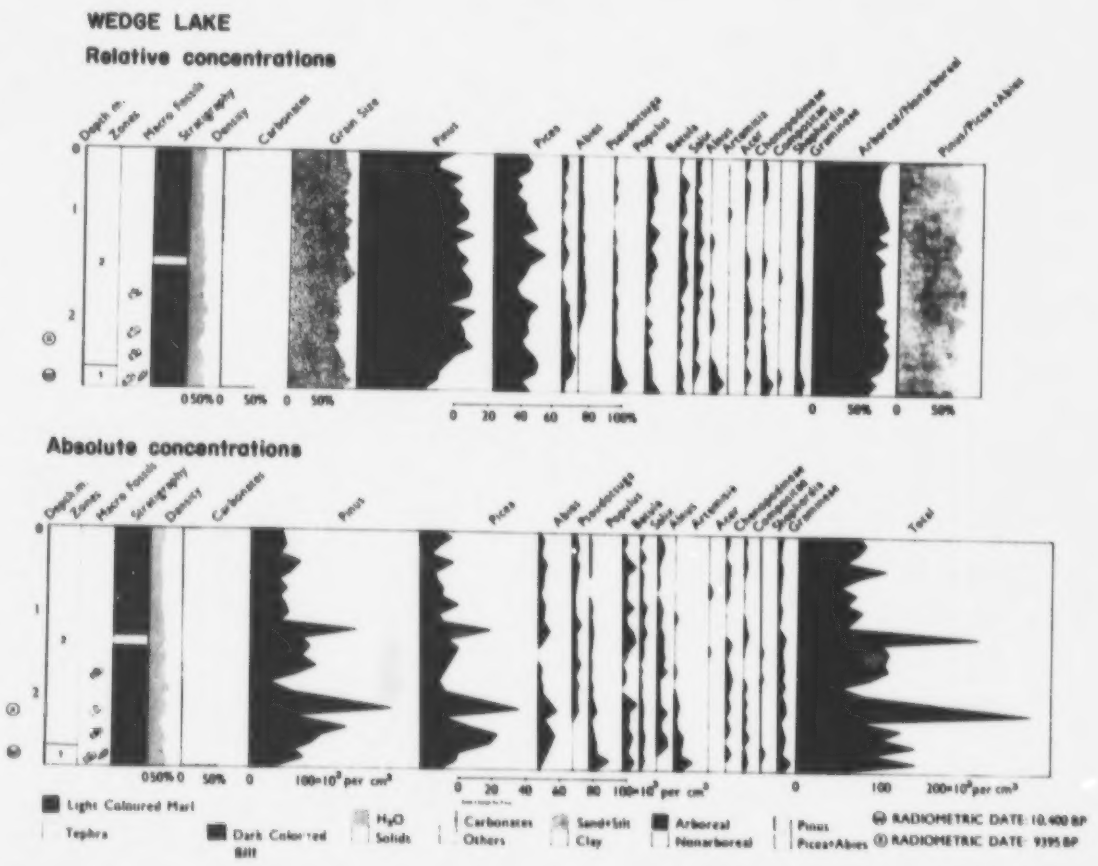

Figure 93. Wedge Lake relative percentage and pollen influx diagrams (reproduced with permission of G.M. MacDonald).

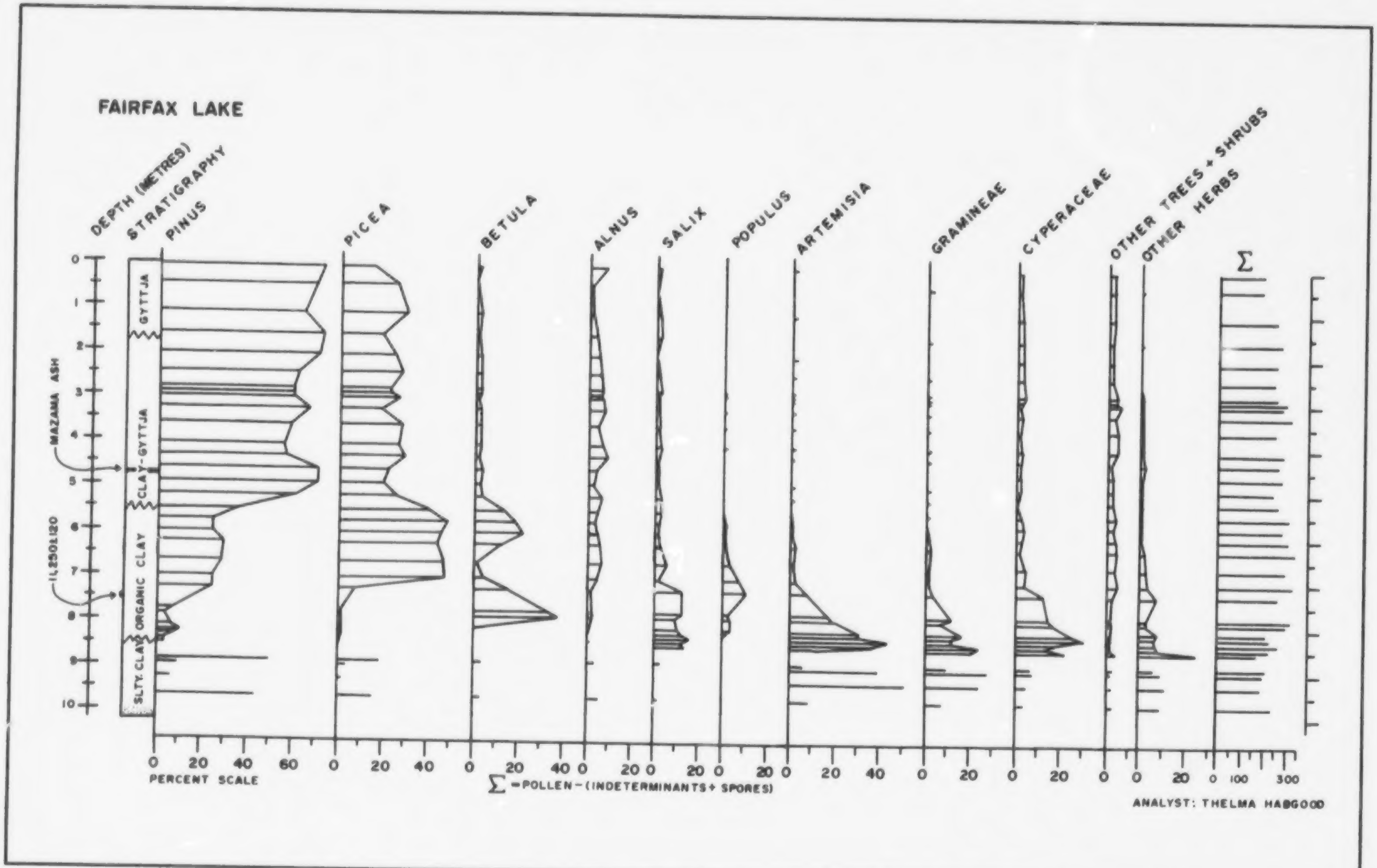

Figure 94. Fairfax Lake relative percentage pollen diagram (reproduced with permission of C.E. Schweger).

The basal non-arboreal assemblage at Fairfax Lake was followed by an arboreal pollen spectrum (about 11,000 years B.P.) dominated by spruce. Pine representation increased at this time but did not reach values indicative of a local presence. Birch was also present, but taxonomic uncertainties make it impossible to say whether tree or shrub birch or both were represented. Considering the non-arboreal nature of the basal pollen assemblage and the observation (Habgood, personal communication 1983) that birch pollen in the lower peak (7 to 8 m) is generally of a smaller size than the upper peak (5.5 to 6 m), it is possible that shrub birch was first to arrive, followed by tree birch. This tentative hypothesis will be adopted in this preliminary model. It implies that tree birch joined spruce in the overstory sometime around 9,000 years B.P. Pine arrived at the site at a slightly later date (about 7,500 years B.P.); its arrival is depicted on the pollen diagram by an abrupt rise to values greater than 50 percent. After the appearance of pine, little change has occurred at Fairfax Lake.

Preliminary results of pollen studies at Goldeye Lake (Schweger, personal communication 1983) and Gregg Lake (Habgood, personal communication 1983) indicate that a sequence of vegetational development similar to Fairfax Lake occurred at both these sites.

A sedimentary record from Mary Gregg Lake has been analyzed for its pollen content as well as other palaeolimnological indicators (Bombin 1982). Coal contamination created problems in radiocarbon dating, but it has been estimated that the lake has existed for some 6,000 years. Palaeolimnological indicators suggest that slight changes occurred in the lake that may have been related to climate, but the pollen record does not reveal any major changes in the local vegetation.

Five sites have been studied in the southern reaches of the Montane Forest, but none of these records appear to extend into late glacial time. Callum Bog may be sufficiently old since the basal sediments contain a unique pollen assemblage made up mainly of spruce, juniper and willow, but no radiocarbon dates are available at this time (the site was re-cored by L.V. Hills in February 1983, and samples have been submitted for radiocarbon dating). Relying on a rudimentary pollen diagram, Alley (1972) suggested that the Callum Bog pollen stratigraphy documented a mid-Holocene elevational expansion of prairie vegetation, an interpretation based mainly on the occurrence of cactus (Cactaceae) pollen, a taxon whose modern distribution does not extend to the elevation of Callum Bog. However, without radiocarbon dates and only limited pollen counts, this interpretation can only be described as tentative.

Driver (1978) analyzed the pollen content of a sediment core from Crowsnest Lake. The basal portion of the core is undated but does extend some 1.5 m below Mazama ash. The earliest sediments contain a pollen spectrum dominated by pine and spruce, indicating mixed-wood forest conditions were established at this time. Subsequent changes in pollen percentages were interpreted as representing grassland expansion from 9,000 to 6,000 years B.P., forest expansion from 6,000 to 4,000 years B.P., grassland expansion from 4,000 to 3,000 years B.P. (although Driver sees this expansion to be less widespread than the earlier event), and the establishment of the existing vegetation 3,000 years B.P.

Sediments from Linnet Lake, located in Waterton Lakes National Park, were analyzed by Christensen and Hills (1971). Near basal sediments were dated to 5,000 years B.P. The pollen stratigraphy was interpreted as representing a relatively open pine forest from 6,600 to 5,000 years B.P., followed by a closed mixed-wood forest from 5,000 to 3,000 years B.P. Increased spruce representation and an increase in the size of grassland openings in the forest, beginning 3,000 years B.P., mark the establishment of the existing vegetation. Little change has occurred since that time.

Bujak (1974) reported results of pollen analysis on sediments from two lakes in the northern portion of Waterton Lakes National Park. Both lakes are within the subalpine forest zone at an elevation of approximately 2,000 m (some 600 m above Linnet Lake). Radiocarbon dating revealed Goat Lake has existed since 4,500 years B.P., while Lost Lake is about 1600 years old. Neither sedimentary record indicated any major changes in vegetation, but a slight trend toward increased forest cover in recent time was noted.

DISCUSSION

Sedimentary records from the Eastern Slopes that extend into late glacial time consistently reveal an assemblage representative of pioneering vegetation on recently deglaciated terrain. It is possible that this type of vegetation occupied the ice-free corridor in earlier times. No modern analogue of this pollen spectrum has been found, but aspects of the pollen records in the area allow a preliminary reconstruction of late glacial environments in the Eastern Slopes.

Three aspects would have dominated the overall appearance of the early vegetation: it was likely sparse, did not display a great deal of diversity (compared to existing flora), and was generally devoid of trees. The only tree present was poplar, and it would have been restricted to sheltered, reasonably well-drained sites or was represented by extensive, low-growing thickets. The landscape would have been dominated by short-lived glacial lakes (created by ice-damming) and numerous meltwater ponds. Sedge mats and willow thickets would have been common around these bodies of water and in areas with a high water table. Well-drained exposed sites would have been inhabited mainly by sage, grass and other herbaceous taxa common today in prairie or tundra settings. Juniper and buffalo-berry were locally abundant, their existence determined by the availability of water.

Since this reconstruction is based on early palaeoecological records from the Eastern Slopes region and, in one instance, is documented as early as 18,000 years B.P., it is logical that it be considered a preliminary model of the vegetation within the ice-free corridor. Descriptions of Late Pleistocene vegetation in the Yukon and Alaska indicate that sedge, grass, and sage dominated the flora (Hopkins et al. 1982), and this assemblage is in some ways reminiscent of the early assemblage recorded in the Eastern Slopes of Alberta. Although the proximity of glacial ice in the ice-free corridor would strongly affect local climatic and hydrologic conditions and would have resulted in slightly different environmental settings, it is nevertheless reasonable to expect some degree of floristic affinity between the two areas during glacial time, since the ice-free corridor is a hypothesized migrational pathway.

As no modern analogue exists for the earliest vegetation in the Eastern Slopes, direct climatic interpretations are impossible. The composition of the vegetation creates additional interpretive problems, since sage and grass (major constituents of the early vegetation) are recorded in abundance in modern pollen samples from both tundra (Cwynar 1982) and grassland (Lichti-Federovich and Ritchie 1968) environments. However, taxa normally associated with grassland environments, such as plantain and chenopods, are present in the early records and their presence hints at the existence of grassland.

Reconstructions of full-glacial climatic conditions suggest that dry conditions prevailed. Westerly flow (the main source of moist air today) was likely confined to the south of the continental ice sheet year-round during glacial time (Bryson and Wendland 1967; Hare 1976). Bryson and Wendland (1967) have speculated that a high pressure ridge over Hudson Bay would have been a near permanent feature of full-glacial climates. The clockwise flow of air around this high pressure ridge, combined with the compression and resultant warming of air dropping off the ice sheet, would have produced strong, relatively mild, dry southeasterly winds in the ice-free corridor (Lamb 1977). Furthermore, southerly excursions of Arctic air (a common feature of Alberta's weather today) likely would have been prohibited since the elevation of the Laurentide ice sheet is estimated to have been greater than the observed height of the Arctic air mass (Bryson and Wendland 1967). These hypotheses suggest that climatic conditions during glacial times in the Eastern Slopes involved less seasonality than now (at least at lower elevations), less precipitation, and a prevailing strong southeasterly wind that was relatively mild and dry. Such a reconstruction could be used to support a shrub-grassland interpretation, as opposed to the shrub-tundra interpretations cited above; however, the evidence is insufficient at this time for firm conclusions. More research involving pollen influx and plant macrofossil analysis is necessary to accurately reconstruct the late glacial vegetation in the Eastern Slopes.

As glacial recession proceeded, trees began to invade the Eastern Slopes. Spruce was the first coniferous taxon to arrive. It was abundant in the Kananaskis area prior to 10,400 years B.P. and appeared at Fairfax Lake 11,000 years B.P. Birch was likely the next tree taxon to arrive; it was present at Yamnuska Bog about the same time spruce appeared and was first recorded at Fairfax Lake slightly after the arrival of spruce, some 9,000 years ago. Pine appeared in the Kananaskis Valley about the same time as spruce (prior to 10,400 years B.P.), was present at Chalmers Bog sometime prior to 8,200 years B.P., and made its way north to Fairfax Lake by about 7,500 years B.P. This period of tree migration (approximately 11,000 to 7,500 years B.P.) was the time of greatest vegetational change in the Eastern Slopes. It is probable that these vegetational changes were related mainly to migration of species from glacial refugia. Spruce and birch are known to have been displaced south of the ice sheet during glacial time (Wright 1971); however, the location of pine glacial refugia is less certain. It has been suggested that high altitude areas of the Rocky Mountains would have been a likely location (Love 1959), and the early appearance of pine in the Kananaskis Valley lends support to this hypothesis.

As was the case with the late glacial vegetational record, the early forests of the Eastern Slopes have no modern analogues; therefore, direct climatic interpretations are impossible. During glacial recession, however, climates were undoubtedly undergoing major alteration, and some observations on the gross aspects of climatic changes in the Eastern Slopes are possible.

As the continental ice sheet disintegrated, the once dominant high pressure ridge over Hudson Bay would have broken down and this, combined with a northward shift of the westerlies (made possible by removal of the ice sheet barrier), would have brought about a shift in the direction of dominant winds in the study area from the southeast to the west. By 9000 years B.P., the separation of Laurentide and Cordilleran ice would have been sufficient to allow southward incursions of Arctic air into Alberta (Bryson and Wendland 1967). The most probable result of these modifications in atmospheric circulation would be increased precipitation and increased seasonality in the Eastern Slopes.

After migration of the dominant tree species into the study area (a process that was completed by about 7,500 years B.P.), little in the way of vegetational change seems to have occurred. Study sites located north of the North Saskatchewan River display no major changes. This may be misleading, however, since pollen studies are of limited value in documenting minor vegetational changes in temperate forest environments due to the fact that pine produces an abundance of pollen that tends to "drown out" minor constituents. Because of this factor, minor changes (for example, expanded grassland openings in the forest) will not produce a strong signal in the pollen record. Palynological and plant macrofossil analysis of a network of small sampling locations (for example, lakes less than 10 ha in size) would help to alleviate this problem. Until such studies are completed, it is only possible to say that, in the northern portion of the Eastern Slopes, no major vegetational changes have occurred since 7,500 years B.P.

Evidence from more southerly sites suggests that minor adjustments occurred during this time period. In the Kananaskis Valley, there is evidence that fires were more common in the early Holocene, peaking in frequency just prior to the deposition of Mazama ash. Slightly west, at Chalmers Bog, there was a minor increase in herbaceous taxa (suggesting a somewhat more open type of vegetation) directly above the Mazama ash layer. Further south, at Callum Bog, tenuous evidence exists for a mid-Holocene expansion of prairie vegetation. Similarly, analysis of sediments from Crowsnest Lake reveals evidence of periods of grassland expansion during early and mid-Holocene time. All of these vegetational changes fall within the period of warmest temperatures recorded throughout many regions of the northern hemisphere, an event known as the Hypsithermal Interval (Deevey and Flint 1957).

Recent palaeolimnological research in east-central Alberta (Schweger et al. 1981) demonstrated that during the early stages of the Hypsithermal Interval (9,000 to 6,000 years B.P.), grassland or parkland vegetation replaced forests; fires were more common; and lake levels dropped. Vance et al. (1983) reported palynological analysis of three lakes in the same area and concluded that the warm, dry Hypsithermal Interval persisted until about 4,000 years B.P.; however, its effects were less pronounced in its later stages (6,000 to 4,000 years B.P.), especially at the westernmost study site (located about 170 km east of Fairfax Lake). Unfortunately, no palynological studies that span a similar time period have been completed in the southern grassland area of the province.

Preliminary indications of Holocene climatic change in southern Alberta may be derived from other sources of palaeoecological information. A study of mollusc remains in lake sediments from southwestern Alberta suggested that a warm, dry climatic interval occurred between 9,000 and 7,000 years B.P. (Harris and Pip 1973).

Waters' (1979) study of palaeosols in the foothills of southwestern Alberta revealed that grassland expanded into forested areas between 9,000 and 6,600 years ago. Reeves and Dormaar's (1972) analysis of palaeosols in the upper Oldman River area indicated that tree lines increased in elevation from 6,700 to 6,000 years B.P. They interpreted this evidence as an indication of warm, dry mid-Holocene climates. Although not in total chronological agreement, these diverse lines of evidence all suggest warmer and drier climatic conditions in southwestern Alberta during early to mid-Holocene time. Although palynological evidence from southwestern Alberta cited in this report indicates that conditions were not as severe as those experienced in central Alberta at this time, there is some indication of slightly warmer and drier conditions, particularly in the extreme southwestern corner of Alberta.

Chinook frequency and winter dominance of Pacific air over Alberta may have accounted for the observed vegetational responses. Synoptic studies of recent drought years in the western interior of North America attribute excessively arid conditions to increased westerly flow (Borchert 1950; Bryson 1981; Diaz and Andrews 1982; Lamb 1977; Trewartha 1961). An increased westerly flow results in a dominance of mild Pacific air over Alberta year-round, rather than only in summer months, as is the case in years of normal precipitation. If this atmospheric circulation pattern was operative for a prolonged period in the early and mid-Holocene, it would have stimulated vegetational adjustments.

Southwestern Alberta is historically the area of highest Chinook frequency in Alberta (Hare and Thomas 1979) and, if an increased westerly flow occurred during the early and mid-Holocene, it would have produced increased chinook frequency, especially during late winter when the core of westerly flow is at its southernmost point (Bryson and Hare 1974). A regular regime of increased Chinook frequency would likely result in decreased annual precipitation (particularly snowfall) and increased mean annual temperatures. Climatic changes of this type would stimulate higher rates of evapotranspiration and increased fire frequency (particularly in spring since snow accumulation would be minimized), resulting in a decreased area of forest cover and an increase in the area of grassland coverage. If extended over a lengthy time interval, increased Chinook frequency could result in an increase in treeline elevation. Considering the observed frequency of Chinook occurrence in the Eastern Slopes (Hare and Thomas 1979), it appears that these proposed vegetational responses would be most pronounced in southwestern Alberta, subdued slightly in the Bow River area, and minimized in the northern zone (where Chinooks are infrequent today). This is precisely the pattern of vegetational change that is emerging from early and mid-Holocene palynological records in the study area. The vegetational responses to the climate of the Hypsithermal Interval are most pronounced in southwestern Alberta from 9,000 to 6,000 years B.P. but persist in a more subdued fashion in the Crowsnest Lake area until about 3,000 years B.P. From that time to the present, little in the way of vegetational change has occurred in the southern reaches of the study area.

As stated earlier, elevation plays a major role in determining the distribution of the vegetation in the Eastern Slopes. The palynological records discussed in this report broadly cover the geographical extent of the study area but tend to represent mainly lower to mid-altitudes of the region (from a low of 1300 m at Yamnuska Bog to a high of 1500 m at Wedge Lake). Two high altitude study sites located just across the Continental Divide have been analyzed, and palynological records from these sites indicate treeline responses to climatic conditions during the Hypsithermal Interval.

Sediments from Bog A, located about 100 km north and slightly west of Crowsnest Lake, at an elevation of 1585 m, have been studied by Ferguson (1978). The pollen record from this site spans the period since deglaciation (near basal sediments were dated to 10,125 ± 285 years B.P.) and bears a marked similarity to pollen records from the lower elevations of the Eastern Slopes. The early non-arboreal assemblage is represented and is succeeded by a pine-dominated assemblage about 10,000 years B.P. An increase in Douglas fir and herbaceous pollen representation from 8,300 to 6,600 years B.P. is interpreted as representing an upward elevational shift in vegetation zones, a response to warmer and drier climatic conditions. Little change has occurred since 6,600 years B.P.

A bog in the Tonquin Pass, situated near the headwaters of the Athabasca River at an elevation of 1935 m, was cored, and the pollen stratigraphy was reported by Kearney and Luckman (1983). This record spans the last 10,000 years B.P. (basal sediments were dated to 9660 ± 280 years B.P.). The earliest sediments are dominated by arboreal pollen types, with pine contributing the greatest amounts. From approximately 8,000 to 4,300 years B.P., there was an increase in spruce representation, which was interpreted as an altitudinal increase in the upper treeline brought about by warmer and drier conditions. From 4,300 years B.P. until the present, little change is evident.

The Tonquin Pass site is the only site in the northern portion of the mountainous region to exhibit vegetational responses to the climate of the Hypsithermal Interval. It suggests that climatic alterations were of a magnitude to at least stimulate vegetational adjustments at the boundaries of plant communities, areas generally considered as the most sensitive to climatic change.

These two high altitude sites reaffirm, in the broadest sense, the chronology of vegetational and climatic change derived from lower elevation sites in the Eastern Slopes of Alberta; that is, replacement of the late glacial non-arboreal vegetation by forest about 11,000 to 10,000 years B.P. (a result of the migration of tree species from glacial refugia), followed by vegetational adjustments during the Hypsithermal Interval, from 9,000 to 4,000 years B.P. (adjustments that appear to be most pronounced in the southern reaches of the Eastern Slopes), and culminating with the establishment of modern vegetation throughout the study area by approximately 3,000 years B.P. It must be emphasized, however, that the sequence presented here is best regarded as a preliminary model of environmental change and is a "broad-brush" approach to the subject. More sophisticated, site-specific reconstructions will await additional research employing plant macrofossil, diatom or gastropod analysis, as well as a more comprehensive network of palynological study sites involving smaller sites and sites located in transition zones.

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THE STATUS OF PREHISTORIC RESEARCH IN ALBERTA'S EASTERN SLOPES

By
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INTRODUCTION

This paper presents a review of prehistoric archaeological studies undertaken in the southwestern portion of the province of Alberta. The Eastern Slopes region consists of the foothills and the Rocky Mountains east of the Continental Divide, an area of considerable topographic and ecological diversity. Although archaeological studies in this region have relatively recent beginnings, a substantial number of studies have taken place since the late 1960s. A long span of intensive prehistoric exploitation has been uncovered, but much of the data on which our understanding of the prehistory of the region are based have not been published. It is not my intent here to restructure the existing information into a new organizational framework along chronological or adaptive lines. Instead, I will summarize the studies conducted to date, review the nature of the current data base, and describe the character of existing interpretations.

This presentation is structured in four sections. The first establishes the boundaries of the region under discussion, considers the historical development of archaeological research in the area, and examines the nature of the survey coverage and the types of analytical components available as a result of excavation. The second section provides a summary of locational and descriptive information extracted from site forms. Only a few synthetic interpretive models have been developed to explain the archaeological data in the region. The third section of this paper attempts to discuss the nature and bases of these culture historical and land use models. The paper concludes with a brief treatment of existing knowledge gaps, pertinent research problems, and the potential directions of current and future archaeological enquiry.

REGIONAL DEFINITION

On the very broadest scale, Alberta consists of two major topographic units, the interior Plains and the Rocky Mountain/foothills uplands. In every sense, the most environmentally varied of these is the uplands or Eastern Slopes. This variation has served to structure the characteristics of the resources upon which prehistoric groups based their survival, as well as the character of the archaeological evidence. Because much of the following discussion is organized along environmental lines, it will be necessary to briefly review the salient features of the region.

PHYSIOGRAPHY

The Alberta Rocky Mountains are part of a massive series of ranges stretching from Alaska to Mexico, covering a 700 km long portion of the western edge of the province. Tectonic thrust faulting has resulted in successive ranges of folded and stacked beds of sedimentary Palaeozoic and Mesozoic strata. These westward dipping slabs trend in a northeasterly direction and vary in number and elevation from south to north (Green and Laycock 1967).

The result of this set of processes is that three distinctive units can be recognized as defining the Eastern Slopes: the foothills, the front ranges and the main ranges of the Continental Divide. North of the Bow River corridor, the main ranges have been uplifted higher than those to the south. In the north, there are numerous front range systems east of the main ranges, and the foothills zone is a broad belt. In the extreme south, foothills are virtually absent, and the Continental Divide is only a few kilometres west of the plains.

Between these uplands areas are linear northwest-southeast trending valley systems which have been heavily modified by glacial activity and which contain streams, rivers, lakes and bogs. Several major fluvial valleys crosscut the uplands systems, beginning in main range glaciers and flowing eastward into the plains, parklands and boreal forest. In terms of the prehistoric use of the area, these valleys are perhaps the most important feature of the region since they provide continuous, relatively level access corridors between the interior plains and the Rocky Mountain trench and into a wide variety of microtopographic resource areas.

Although topographic and other forms of regional variation tend to be expressed in a gradient from south to north, it is convenient to refer to a northern and southern portion of the region. The physical representation of this division lies roughly between the Bow and North Saskatchewan river basins (Figure 95). It should be noted, however, that references to this north-south partition represent only general tendencies, not precisely defined intraregional differences.

CLIMATE AND BIOTIC REGIMES

Climate in Alberta is primarily determined by the interplay between the Pacific and Arctic air masses. The Eastern Slopes region is the focal point for this interaction and exhibits the greatest climatic variation of any region in the province. The more frequent presence of mild Pacific air in this region tends to moderate the seasonal extremes of Alberta's largely continental climate. Prevailing westerlies which funnel through major passes and valleys are a fairly constant feature of the area, and wind direction has a significant influence on vegetation communities (Longley 1967).

Topographic factors which influence the wide diversity of habitat types in the region include latitude, altitude, slope and aspect. South of the Bow valley, the Continental Divide is both low and in close proximity to the plains. Primarily as a result of the almost year-round presence of the Pacific maritime front, extensive valley grasslands are present. Dry warm westerlies (Chinooks) frequently flow over the mountains in winter and tend to ameliorate the climate, remove the snow cover, and inhibit the presence of trees. To the north, mountain ranges are higher and more numerous, contributing to the overall dominance of the Arctic air mass in this region. Warm westerlies are rare; snow is retained through winter. Conifers dominate the vegetation, and valley grasslands exist only in specific limited areas.

Temperature, moisture and soil types differ with elevation, resulting stacked biotic communities. These habitat zones are somewhat analogous

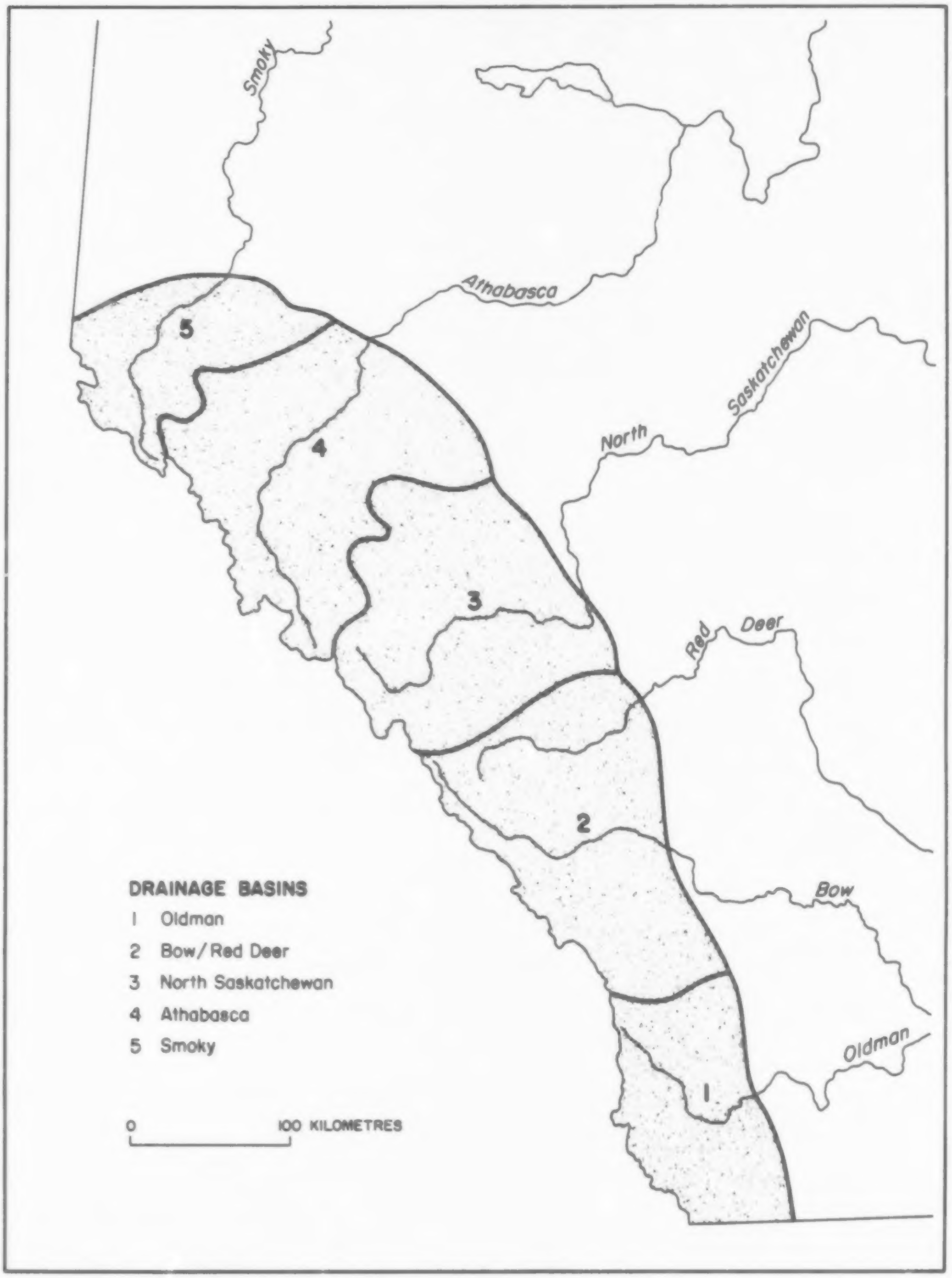
Smoky
Athabasca
North Saskatchewan
Red Deer
Bow
Oldman
5
4
3
2
1
DRAINAGE BASINS
1 Oldman
2 Bow/Red Deer
3 North Saskatchewan
4 Athabasca
5 Smoky
0
100 KILOMETRES

Figure 95. Regional boundaries and drainage basins.

to those distributed by latitude on the interior plains. Four major zones are recognized: (1) grasslands, (2) montane forest (equivalent to a parklands mosaic), (3) subalpine forest (equivalent to the boreal forest), and (4) alpine vegetation (often more closely resembling scrub tundra than true alpine communities) (Moss 1955).

Degree of slope has a great influence on the distribution of vegetation because it controls the nature and depth of soils. Soils exist primarily in valley bottoms. Extremely shallow soil exists in alpine areas, and steep slopes are almost bare. Because of the predominance of conifers throughout the region, soils are generally acidic.

Aspect or facing direction has a great effect on vegetation as well. South-facing slopes receive much more sunlight and thus support more warmth-loving communities than north-facing slopes. West-facing slopes intercept brisk westerlies, resulting in more xeric conditions than on east-facing slopes.

Wildlife communities vary with vegetation and season. In the southern part of the Eastern Slopes, until early historic times, plains bison herds sought the shelter of the foothills and valleys in winter. Behavior of indigenous groups of wood or mountain bison would probably have been similar to that of surviving big game mountain species (moose, elk, deer, and mountain sheep), tending to concentrate in sheltered valleys in winter and dispersing throughout higher elevations in summer. Mountain goats inhabit higher elevations, and woodland caribou are known to have been present in the northern part of the region. Various carnivores and fur bearers also inhabit the diverse ecozones. Fish concentrate in major rivers and lakes but also occur seasonally in small streams throughout the region.

REGIONAL DIVISIONS

Any consideration of a regional data base requires firm definition of regional boundaries. The Eastern Slopes region of Alberta is an administrative subarea within the Archaeological Survey of Alberta. As such, the region has been defined on a physiographic basis with the legal township/range system used to create its eastern margins, roughly approximating the edge of the foothills (Figure 95). Its western boundary consists of the Continental Divide exclusive of the national parks. It consists of approximately 720 townships or 67,135 square kilometres (25,920 mi.^{2}) of provincial lands. Considering that the national parks form a logical extension of the region, the areas comprising Waterton Lakes (525 km^2), Banff (6441 km^2) and Jasper (10,800 km^2) national parks have been included in the regional definition for the purpose of this paper. Consequently, although roughly comparable regions have been defined in other studies (see Reeves 1974d, this volume; McCullough and Fedirchuk 1983, this volume), the region under consideration in this paper is the 85,099 square kilometres (32,857 mi.^{2}) as defined above and displayed in Figure 95.

In order to account for the environmental variation present within this area and to allow potentially instructive comparisons to be made, regional subdivisions have been created. Following the divisions suggested by McCullough and Fedirchuk (1983, revised this volume), the five major drainage basins which comprise the region have been selected as partitioning devices: the Oldman, the Bow, the North Saskatchewan, the Athabasca and the Smoky river basins (Figure 95). Aside from encompassing regional variation, the separation of these basins is considered potentially meaningful because of their varying topographic control over game herd movement and their potential as interregional travel corridors.

ARCHAEOLOGICAL INVESTIGATIONS

SITE SURVEYS

The earliest mention of archaeological sites in the Eastern Slopes occurs in early travellers' journals (e.g., Fidler [McGregor 1966]; Henry [Coues 1897]; Thompson [Hopwood 1971]). Although archaeological sites in the region were recorded as far back as 1874 (Dawson 1874; Smith 1913), professional archaeological studies did not begin until 1938 when Junius Bird visited the southern part of the region to conduct excavations at Head-Smashed-In Buffalo Jump (Reeves 1978a; Brink et al. 1984) and to examine a few other sites. Head-Smashed-In was tested again in 1949 by

Boyd Wettlauffer (1949) of the University of New Mexico. The locations and authors of some of the more recent studies in the Eastern Slopes are displayed in Figure 96.

Systematic archaeological study in Alberta dates only to the last thirty years, beginning in 1955 when the Glenbow Foundation engaged a team headed by H.M. Wormington to conduct province-wide investigations. These studies took concrete form in 1957 when Richard Forbis became established as the first professional archaeologist in the province. The programme sought out site leads provided by local collectors and included limited reconnaissance and excavation (see Wormington and Forbis 1965). Large numbers of sites were recorded between the years 1955 and 1963, some of which occur in the Eastern Slopes area. Forbis also conducted major excavations at Old Women's Buffalo Jump during this period (Forbis 1962).

With the establishment of archaeological programmes at the University of Alberta, Edmonton and Calgary campuses (the latter is now the University of Calgary) in 1963 and 1964, more systematic surveys were undertaken. Perhaps the earliest of such studies involved salvage-oriented surveys of three proposed reservoirs in the Oldman River basin (Forbis 1966). Under Parks Canada contracts, several inventories began in the mountain parks. Reeves directed an intensive inventory of Waterton Lakes National Park (Reeves 1967, 1968, 1970, 1972a), while an extensive inventory of selected sections of Banff National Park was completed by Christensen (1971). Elliott (1970-71) and Anderson (Anderson and Reeves 1975) likewise conducted partial inventories in Jasper National Park and the federally owned Ya-Ha-Tinda Ranch on the upper Red Deer River during this period. More recently, the Archaeological Research Unit of Parks Canada, Western Region has endeavoured to complete the regional inventory in Jasper National Park (Pickard 1984).

Large numbers of sites were identified in a wide variety of topographic situations throughout the parks. These successes served to dispel earlier notions (Forbis 1968) that the mountain terrain and climate were unsuitable for anything but the most ephemeral occupations. Significant results were also obtained in both research and salvage-oriented surveys undertaken along major valley systems in the

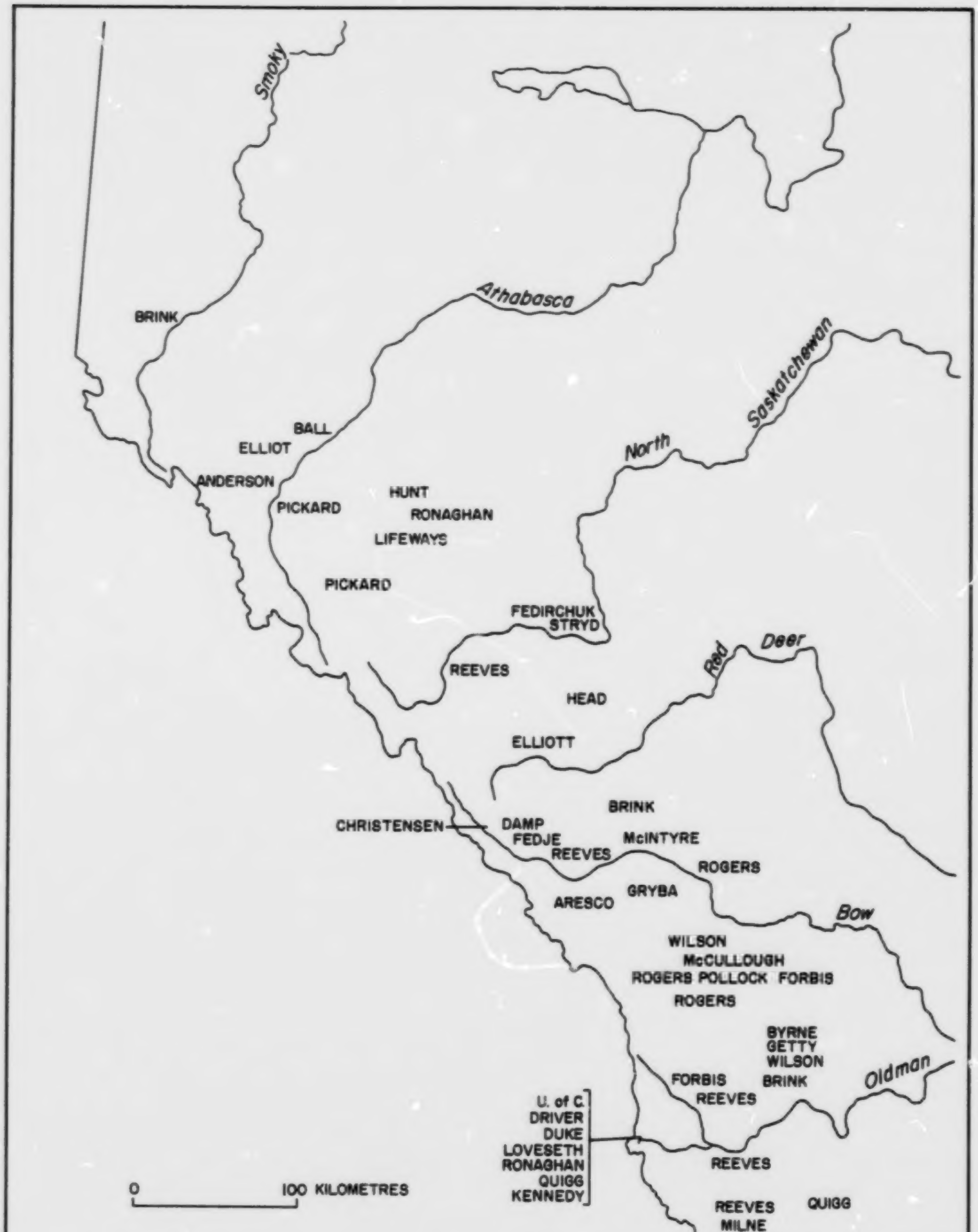
Smoky
Athabasca
BRINK
North
Saskatchewan
BALL
ELLIOT
ANDERSON
PICKARD
HUNT
RONAGHAN
LIFEWAYS
PICKARD
FEDIRCHUK
STRYD
Red
Deer
REEVES
HEAD
ELLIOTT
BRINK
CHRISTENSEN
DAMP
FEDJE
McINTYRE
REEVES
ROGERS
GRYBA
ARESCO
Bow
WILSON
McCULLOUGH
ROGERS POLLOCK FORBIS
ROGERS
BYRNE
GETTY
WILSON
FORBIS
BRINK
Oldman
REEVES
U. of C.
DRIVER
DUKE
LOVESETH
RONAGHAN
QUIGG
KENNEDY
REEVES
0
100 KILOMETRES
REEVES
QUIGG
MILNE

Figure 96. Locations and authors of principal archaeological studies in the Eastern Slopes region.

mountains and foothills in the southern part of the region. In 1972, the University of Calgary began a long-term project in the Crowsnest Pass area. Survey components have been reported by Reeves (1974a, 1974b, 1974c), Driver (1976) and Loveseth (1976). Quigg (1974) surveyed the foothills portion of the Belly River adjacent to Waterton Park. Rogers (1974, 1975) examined portions of the upper Elbow, Sheep and Highwood River basins, all of which drain into the Bow River.

University of Calgary students also undertook a number of surveys in the southern portions of the region for which only site forms are available. These include Byrne's work on Trout Creek, Getty and Wilson's survey of Willow Creek basin, Driver's work along Big Hill Creek west of Calgary, Duke and Ronaghan's Pekisko Creek survey and several others. Surveys in the south involving researchers associated with the University of Alberta have been limited to Bryan's unpublished examination of potential "early man" locales and Brulotte's (1983a, 1983b) survey of Racehorse and Daisy Creeks in the upper Oldman basin.

Outside of the national parks in the north, the distribution of surveys is considerably different. Academic research oriented studies are almost nonexistent. Reeves' (1972b) unreported Big Horn reservoir management study along the upper North Saskatchewan valley in 1972 is perhaps the only areally extensive early study. Research-related surveys have been virtually limited to Archaeological Survey of Alberta (ASA) staff research along the upper Smoky and Sulpher Rivers (Brink 1979) and a section of the Athabasca River from the Jasper Park boundary to Hinton (Ball 1984, this volume).

Since the inception of the Alberta Historical Resources Act (Revised Statutes 1980) and the ASA archaeological research permit system in 1973, the focus of survey work has been, with few exceptions, toward assessment of development impact. Studies can be grouped into spot developments such as small recreation areas, potential gravel pits and small subdivisions; linear developments such as highways, pipelines and transmission lines; and regional developments such as impoundments and coal mines. As of the end of 1985, 192 permits have been granted for the conduct of historical resources impact assessments (HRIAs) in the Eastern Slopes area.

Because it is not possible to detail all of these studies here, the reader is referred to the bibliography included in this volume (Reeves). Generally, spot-specific studies have been neither frequent in number nor extremely productive of significant finds. Exceptions include Brink's recording of the Sibbald Creek (EgPr-2; Brink 1979) and Fallentimber Creek sites (EiPs-6; Brink 1980) during investigation of small provincial campgrounds, and Reeves and Driver's recovery of butchered Bison antiquus remains in a small sewer excavation in Bellevue in the Crowsnest Pass (Reeves 1975).

Most studies have been of linear projects - pipeline, power line and road construction projects - which proliferated during the boom period of the late 1970s and early 1980s throughout Alberta. Of course, route selections frequently had little relationship to the potential of various land forms for containing prehistoric sites. Thus, archaeological surveys of these projects frequently had the opportunity to examine areas quite peripheral to known settlement loci. However, contemporary notions regarding terrain potential influenced the nature of these studies. Selection of those project areas requiring examination was (and is) made by the ASA regional archaeologist. Selection of microtopographic locales for intensive surface and subsurface examination was made by the field archaeologist. As a result, these linear surveys are in no way unbiased transects across the varied terrain of the Eastern Slopes.

Nevertheless, examinations of linear projects have resulted in the discovery of large numbers of significant sites, some in locations not previously believed to have potential for such finds. Many projects have been small in nature, but others have amounted to major regional studies. In the latter category would be the University of Calgary's studies along the Highway 3 realignment through the Crowsnest Pass (Reeves 1974a, 1974b, 1974c); Aresco's examination of the "prebuilt" section of the Alaska Highway Pipeline (Wright 1979; Wright and McFee 1979); Heitzmann et al.'s (1981) assessment of dispersed secondary highway projects in the region; McCullough and Reeves' (1978) survey of Dome's Waterton to Cochrane ethane pipeline; and Head's (Reeves and Head 1979) studies involving Shell's Limestone Gas gathering system.

Assessments of large regional developments (e.g., impoundments, coal mines) have been fewer in number than linear projects. Being less constrained by a rigidly defined right-of-way, more latitude is usually allowed to the archaeologist in terms of survey strategy. However, time and budget constraints, depending on the size of the project and nature of the terrain, have generally resulted in no less judgementally biased studies than is the case for linear projects. As with other developments, the areas examined have not necessarily coincided with areas of known archaeological potential, with the exception of impoundments. Consequently, valuable knowledge regarding site distributions and regional settlement patterns outside main valley systems has been gained.

Early examinations of impoundments in the Eastern Slopes have been previously mentioned, but note should be made of the Dixon Dam studies on the upper Red Deer River (Fedirchuk 1978; Stryd and Lawhead 1981) and an ongoing impact assessment at the proposed Oldman River Dam near Pincher Creek (Reeves et al. n.d.). The latter study will be the most intensive of its kind to date. Elsewhere, proposed coal mines have been the major impact on a regional level. Studies of note here are Calder and Reeves' (1977) work at Luscar's Coal Valley mine, and the author's examination of the Denison Robb and Manalta Mercoal and McLeod River mines (Ronaghan 1981, 1982a, 1982b). These have all taken place in the Coal Branch area south of Hinton in the heavily forested northern foothills.

Several salient points emerge from consideration of the nature of survey coverage in the region. First, early studies not related to developments tended to be more productive in terms of site discovery because study areas were generally large and of high potential. Furthermore, the freedom to explore positive associations between topographic features and archaeological sites was generally present. In contrast, development projects represent more arbitrary overlays on the diverse landscape and, consequently, often as much negative as positive information regarding site location has been generated. Second, unless the various cultural resource management (CRM) projects are considered to be a form of sampling by virtue of their somewhat arbitrary locations, survey coverage must be considered to be completely of a judgemental nature in the Eastern Slopes of Alberta; that is, no probabilistic sampling techniques have been applied on any site survey in the region. Third, studies undertaken prior to institution of the Interim Guidelines for Historical Resources Impact Assessments (Government of Alberta 1979) did not involve subsurface prospecting in site survey, and only in certain circumstances were sites tested for assessment purposes. As a result, survey coverage of areas examined prior to 1977 is generally considered inadequate for CRM purposes, and site assessment would be necessary to confirm impressions about the character and significance of the sites recorded.

EXCAVATIONS

Archaeological excavations undertaken either for research or CRM purposes have yielded the bulk of what we know of culture historical sequences and the behavioral aspects of adaptations in the Eastern Slopes region. With regard to culture history, the southern Eastern Slopes is perhaps the best understood area in the province. In terms of adaptive processes, however, understanding is still at a preliminary level.

The first major reported excavation in the Eastern Slopes was conducted in the late 1950s by Forbis at Old Women's Buffalo Jump. Analysis of the material recovered from the jump provided the first concrete formulation of the local cultural sequence in Late Prehistoric times (Forbis 1962).

Reeves' excavations, initially at the Kenney site (1966) in the Oldman River valley and later at Head-Smashed-In Buffalo Jump (1978a) and Waterton Lakes National Park (1968), formed the basis of a major chronological scheme for the Late Middle Prehistoric Period. The University of Calgary contract and field school excavations in Waterton Park (Reeves 1970, 1972a) and in the Crowsnest Pass (Driver 1978a, 1978b, 1983; Graspointner et al. 1978; Loveseth 1980; Quigg 1975; Reeves and Driver 1978) served to provide an expansion of Reeves' chronology into the Early and Early Middle Prehistoric periods. Other excavations of note in the Oldman River basin include Quigg's (1974) work on the Belly River; Milne Brumley's (1971) excavations at the Narrows site; and Byrne's unpublished excavations on Trout Creek. These latter studies provided conclusions of a more adaptive behavioral nature. The above studies, coupled with Reeves and Dormaar's (1972) early work with palaeosols at the Gap of the Oldman River, Brulotte's (1983a, 1983b) excavation in the Racehorse Creek Rockshelter and Brink et al.'s (1984) renewed excavations at Head-Smashed-In, make the Oldman River basin the best archaeologically known area in the province.

North of the Oldman drainage, excavated samples decrease in frequency. Within the main valley of the Bow River, by far the most important excavations have been those of the Parks Canada Archaeological Research Unit at the Vermilion Lakes site (Fedje, this volume). This site has provided one of the longest sequences of well-dated occupations thus far recovered in Canada. Elsewhere, along the Bow River, Damp et al.'s (1980) studies at EhPw-2 and EhPw-4 inside Banff park boundaries and McIntyre's (1978) excavations of rings west of Cochrane are noteworthy. Notable studies outside the main valley of the Bow River include Wilson's (1977) excavations of ring sites in the Longview-Pekisko Creek area; Quigg's (1982) and McCullough and Fedirchuk's (1983) research on the Elbow and Sheep rivers; Gryba's (1983) landmark excavation of fluted points at the Sibbald Creek site; and Reeves and Murray's (1973) work at Wasootch Creek in Kananaskis Country.

Virtually no major excavations have been conducted in the Red Deer, North Saskatchewan and Athabasca river valleys. Excavated samples from two upland interior study areas provide some contrast to what is largely a major gap in detailed regional archaeological knowledge. Head (1980) tested several sites in the Limestone Mountain area, revealing an unexpected settlement pattern relating to lithic exploitation and localized subsistence based on dispersed uplands resources. Conservation excavations in another foothills uplands area known as the Coal Branch (Calder and Reeves 1977, 1978; Hunt 1982) have provided some chronological and behavioral information on a similarly unexpectedly dense settlement pattern in the area, largely during Middle Prehistoric times.

Brink's (1975) investigations along the Smoky River and in the Grande Cache Lake area provide the only excavated samples from this vast northern portion of the region. Summaries of the excavations at the Smoky and Grande Cache Lake sites presented in this volume constitute the first detailed published record of this work.

Excavation techniques, results and reporting have been conditioned by various factors including the character of the resources, the historical development of archaeology in Alberta, and, in recent times, the need for conservation as determined under the Alberta Historical Resources Act. Sites in the Eastern Slopes, especially in the northern portion of the region, are frequently shallow with highly compressed stratigraphy. When deeply buried, as is often the case in the south, sites have been deposited on rapidly aggrading land forms where stable surfaces are rare and stratigraphic separation is difficult to recognize. As a result, there is an almost universal use of an arbitrary 10 cm level for vertical control in excavation. Because of the difficulty in recognizing horizontal contiguity of occupation floors and features, large en bloc exposures of single occupation surfaces have been rare, with the notable exception of tipi ring sites.

While the growth of CRM studies since the early 1970s has resulted in the development of efficient techniques for information recovery and report production, analyses largely remain at a descriptive level. Specialized interpretive analyses have generally involved a limited number of projects undertaken by graduate students. Although a wide variety of factors are responsible for this somewhat regretable circumstance, at least permit reports are produced and collections are described and accessioned. Several important university and government studies conducted prior to the enforcement of permit regulations languish with collections unanalyzed and reports unwritten.

Potential for future archaeological research in the area is considerable. Many potentially productive areas have not been adequately surveyed. Many significant sites have not been adequately investigated and numbers of collections are available for specialized analysis or comparative reanalysis.

PALAEOENVIRONMENTAL DATA

The timing, extent and effect of glacial activities in the Eastern Slopes of the Rockies, including Alberta, is perhaps the most critical information set necessary for understanding earliest human occupations, not only of the region but possibly of the entire continent. Wisconsin glacial events are the subject of considerable ongoing debate among quaternary geologists, and it appears that no overall concensus exists.

Problems appear to centre around differing opinions regarding the recognition of till units and the dating of those recognized.

Localized studies within the region (e.g., Alley 1973; Boydell 1978; Jackson 1979; Roed et al. 1967; Rutter 1972, 1976) have been summarized and correlated by a number of authors (Clayton and Moran 1982; Denton and Hughes 1981; Rutter 1981; Stalker 1977). The disagreement evident among the geologists presents archaeologists with a somewhat confusing picture, making the modelling of early human occupation of the region difficult.

Palynological studies provide a record of vegetation changes following deglaciation. Pollen studies have not been intensive or systematic throughout the area and only one summary of work in the Eastern Slopes exists (Vance, this volume). Twelve study sites occur in the region (Vance, this volume) and provide the earliest basal dates in Alberta. These range from 18,000 years in the south (Mott and Jackson 1982) to around 11,000 years in the north (Schweger et al. 1981). The vegetative changes recorded early in these sequences are perhaps the most dramatic in the province and would have undoubtedly affected the character of early human occupation. Most published data allow for a reasonable preliminary reconstruction of later vegetation sequences for the area including recognition of the Hypsithermal Interval at southern sites (Vance, this volume).

A limited number of other forms of palaeoecological study add further data toward reconstruction of vegetational sequences. These include a study of mollusc remains (Harris and Pip 1973) and two palaeosol studies (Reeves and Dormaar 1972; Waters 1979). Study of post-glacial geomorphic sequences are rare, with Wilson's (1983) reconstruction of events on the Bow River along the east central part of the study region representing the most relevant work in terms of human occupation.

I am not aware of any applications of the tree ring dating technique for reconstructive purposes. The Alberta Forest Services does occasionally record short-term data. With the possible exception of Churcher's (1968, 1975) work near Cochrane, detailed faunal sequences do not exist for the Eastern Slopes area. Specimens recovered from the area have formed a portion of Wilson's bison evolution research (Wilson 1969, 1974, 1980). General sequences established on the plains provide the only detailed reference for the Eastern Slopes.

STATUS OF THE REGIONAL DATA BASE

Existing information regarding the prehistoric and historic period archaeological resources in Alberta consists of site records, a series of 1:50,000 scale maps showing site locations, written reports, material collections and some ancillary data (maps, photographs, catalogues, etc.). Considerable variation exists in the data base on record. Individual site recorders, especially in the early 1970s, did not always fill in all categories on site forms nor were statements detailed. Furthermore, a lack of standarized terminology regarding functional site types and material descriptions makes effective comparative use of the informational data base quite difficult.

Nevertheless, in late 1983, it was decided to employ the information available in the site records as a research and management tool for providing summary descriptions of the prehistoric data base in the Eastern Slopes. All prehistoric sites in the region were tabulated and a number of descriptive categories were recorded for each. These categories included site type, age (determined either by C14 or diagnostics), condition, exposure (i.e., facing direction), primary drainage association (stream order; as per Horton 1945), distance from drainage, topographic association, latitude, altitude, associated vegetation, and major drainage basin.

Analysis of the results of this regional tabulation cannot be conducted in rigorous, statistically predictive manner because the records cannot be viewed as a representative, unbiased or consistently described sample of the existing prehistoric data base in the region. Additional factors influencing the comparability between areas within the region on the basis of the site records include differences in the amounts of archaeological investigations conducted in various areas and changes in investigative techniques; differences in size and accessibility of the regions in question; differences in site visibility factors between areas (i.e., vegetation, deposition and levels of present disturbance); and differential skills of individual site recorders. It is suspected that most regional data bases suffer similar problems and that caution should be exercised in evaluation of their characteristics.

SITES AND SITE TYPES

As of 1983, 3,314 prehistoric sites had been recorded in the Eastern Slopes of Alberta. These range from isolated finds of a single artifact to large multicomponent sites representing intense, repetitive exploitation of local resources. The four most common site types are campsites, buried sites, tipi rings and surface scatters. These account for 77.25 percent of all sites in the region. Over 86 percent of all sites have been recorded in the Oldman and Bow River basins. The vast majority of sites have been identified on the basis of brief surficial examinations; consequently, little substantive information, upon which to assign site type, has been obtained. In many cases, simple descriptive terms such as surface scatter, buried site or stone feature have been employed. In most cases, however, some attempt has been made here to infer site function. The term campsite, for instance, generally refers to the presence of fire-cracked rock and/or some variety of technological or functional lithic types. This is not always the case, however, nor can such a functional ascription legitimately be made without more extensive investigation and analysis. A similar case can be made for other functional identifications such as workshop, processing site or kill. Although the limitations of the data base must be recognized, the observed variation in site characteristics still provides a useful basis for summary description and regional comparison. The site types identified by field investigators and those tabulated for this study are displayed in Table 27.

DISTRIBUTION OF SITE TYPES

For regional comparative purposes, the distribution of functional and descriptive site types was broken down by the major drainage basins previously described (Table 27). The totals in each drainage basin primarily reflect the levels of work conducted in each, but they also reflect site visibility and probably, to some degree, cultural factors such as settlement patterns and aboriginal populations.

Stone feature site types (tipi rings, cairns, alignments), considered typical of a plains-oriented adaptive strategy, are limited to the two

Table 27. Prehistoric archaeological sites in Alberta's Eastern Slopes.

SITE TYPES	DRAINAGE BASINS					TOTAL	%
	Oldman	Bow	N. Sask	Athab.	Smoky		
stone ring	230	103				333	10.05
cairn	154	38	1		1	194	5.85
rock alignment	24	2				26	.79
stone feature	12	2				14	.42
effigy	6					6	.18
medicine wheel	1	3				4	.12
isolated find	89	113	4	43	5	254	7.67
surface scatter	112	214	16	89	25	456	13.76
buried site	231	119	55	78	39	522	15.75
campsite	389	774	47	32	7	1249	37.69
cave	3	2	1			6	.18
rock shelter	11	2		1		14	.42
house pit		2				2	.06
burial	13	3				16	.48
pictograph	7	5		1		13	.39
petroglyph		2				2	.06
kill site	25	27				52	1.57
bison jump	13	10				23	.69
pound		3				3	.09
processing site		6				6	.18
jump complex	5	3				8	.24
workshop	13	62	1	1	1	78	2.36
quarry	18	5				23	.69
collection	5	4				9	.27
vision quest	1					1	.03
Total	1362	1504	125	245	78	3314	
%	41.10	45.38	3.77	7.39	2.35	99.99	99.99

most southerly drainages, the Oldman and Bow. This relates to culture historical, environmental and site visibility factors. Undoubtedly, the existence of extensive grasslands in these areas resulted in the presence of bison and prehistoric economies centred on their exploitation. This is further demonstrated by the fact that large communal bison kill sites, such as jump complexes and pounds, occur only in these southern drainage systems.

Superficially then, it would appear that the southern Eastern Slopes, at least the foothills zone, falls fully within the Plains cultural sphere. The rather heavily forested zones north of the Bow corridor may conceal stone feature sites such as the buried rings mentioned by Reeves (1981:35) for the Limestone Mountain area, but these occurrences are probably extremely rare.

In the northern portion of the region, the Nordegg Chert locale in the North Saskatchewan basin and the Glacier Pass complex (Elliott 1970-71) between the Athabasca and Smoky basins have been recorded here as workshops because no true quarry sites have yet been identified in association. Nevertheless, their presence serves to indicate exploitation of local bedrock materials. The relative absence of specialized types of sites, such as workshops and quarries, north of the Bow River basin is somewhat surprising. Considering the geomorphological complexity of the region, numerous surficial occurrences of potentially useful bedrock formations undoubtedly exist. Obtaining and processing lithic materials from such sources, as well as from the abundant alluvial sources in the region, must have left a considerable residue of sites. The fact that these sites have not been identified in any numbers likely reflects a combination of factors including lower survey intensities, use of inappropriate strategies for discovery, and the sheer size and inaccessibility of the region. Alternatively, many sites classified as surface scatters, campsites and buried sites may, with more comprehensive assessment, be assigned a workshop function as has been demonstrated by some excavations conducted to date (e.g., Calder and Reeves 1977, 1978; Hunt 1982). In any case, there is a need for greater understanding of lithic source use north of the Bow River basin.

Also somewhat surprising is the absence of kill sites in the northern portion of the region. The often limited amounts and highly fragmented nature of bone recovered in campsite excavations (Brink, this volume; Calder and Reeves 1977; Hunt 1982) suggest that big game animals were probably the major food source exploited during prehistoric times. The fact that large ungulate kill and processing sites have not been recorded in the region can be related to ecological and cultural factors. In the south, because of the presence of a highly gregarious migratory species, such as bison, kill sites were usually located strategically with regard to surrounding terrain and resulted in multiple kills. The more solitary, less widely ranging northern species, such as deer and moose, probably necessitated more dispersed individual kills. Cultural systems adapted to these dispersed conditions may have resulted in the distribution of kill sites within catchment areas surrounding base camps. Indeed, primary processing at kill sites may have left not much more than a cranium, some hooves and entrails. After such remains are exposed to weathering and carnivores, and are then buried in the highly acidic soils which characterize this region, little would remain to be identified by archaeologists. However, survey efforts have not been dedicated to areas where small kills such as these likely occur. Consequently, the above scenario is quite speculative.

Communal kills, characterized by concentrations of bone resulting from staged processing sequences, may exist north of the Bow basin. However, if it can be assumed that terrain breaks such as river and creek valleys present the most likely locations for sites of this nature, survey results to date suggest that they may be extremely rare or absent. Other potential locations outside valley systems, such as the margins of wetlands and small enclosed valleys, have not received examination.

Many other types of sites, such as effigies, medicine wheels and vision quest sites, are also limited to, or have been identified almost exclusively in, the two most southerly basins. Although these more stylistically distinct varieties constitute quite minor proportions of the entire sample, their absence in the north may be suggestive of cultural differences between the areas. It is not known how far back in time a distinctive Plains culture can be recognized, but its presence is certainly indicated for the southern foothills zone in the south at least during the Late and Middle Prehistoric periods.

The almost complete lack of recorded caves and rock shelters north of the Bow River basin (but see Hall 1976) may be an artifact of lower levels of investigation. However, a number of potential locations for such sites in this region were investigated in the 1970s by University of Alberta students with limited results (Brink, personal communication 1986). In spite of this, it is safe to say that the potential for prehistoric use of caves and rock shelters north of the Bow basin has not been sufficiently investigated to suggest regional differences in this regard.

The absence of prehistoric human burial sites in the north probably is most easily explained by poor preservation conditions in the acidic soils and by the lower frequencies of surveys. This negative evidence does not preclude the possibility of differences in cultural behavior patterns, but there is a low frequency of burials throughout the province.

The general lack of pictograph and petroglyph sites north of the Bow River is another possible indication of cultural differences between the regions. Aside from a single recorded occurrence in Jasper National Park (Snake Indian Cave; Elliott 1970-71), insufficient investigations have been conducted to determine whether these types of sites were generally absent from northern cultural repertoires. Interestingly though, the style of representation in many southern rock art sites (Habgood 1967; Keyser 1978), when coupled with the presence of house pit sites in Banff park (Christensen 1971) and along the upper Red Deer (Elliott 1970-71) and the identification of a possible "Wicky-up" structure in excavated context along the upper Elbow River (McCullough and Fedirchuk 1983; Quigg 1982), suggests a non-plains oriented cultural presence in the southern portion of the Eastern Slopes at least in certain periods. To the north, no such cultural inferences can be drawn given the nature of the current data (but see Pickard, this volume).

CHRONOLOGY

Tabulation of chronological periods represented within the sample presented several problems. Only a few of the sites on record have received even test excavations and, of these, only a limited number have associated radiometric dates. Consequently, in most instances, the only indication of a site's age is the typological classification applied to projectile points recovered either in excavation or from the surface. The difficulties in using any approach based on subjective typologies are well recognized and have been dealt with extensively in numerous other studies (e.g., Driver 1978c; Vickers 1986; Wilson 1986). Recognition of the problems, especially with regard to consistency in identification of named types, as well as the necessity of overcoming small sample sizes, resulted in the decision to record only the major periods recognized in regional prehistories: Early, Middle and Late Prehistoric (Reeves 1978b, 1983; Vickers 1986). An additional category, Proto-historic/Historic Native, was created to account for sites containing trade goods of European origin and indications of relatively modern native use.

Of a total of 3,314 sites, only 260 (7.9%) could be assigned to a chronological period. Stratified, multicomponent sites containing separable occupations of several periods were recorded by component. Thus, 313 components provide the data base for intraregional comparisons. Figure 97(a) presents the relative frequency of components assigned to these periods.

It would appear that the Middle Prehistoric Period is by far the most highly represented temporal unit in the sample (52.1% of components). To some this might not seem surprising considering theories (Benedict 1981; Benedict and Olson 1978; Mulloy 1952; Wedel 1961) which suggest a Mid-Holocene depopulation of the plains and presumably, as a corollary, more extensive use of more climatically attractive uplands areas such as the Eastern Slopes (see Reeves 1973 and Buchner 1980 for discussions of the issue). However, such theories are now outdated and a simple consideration of the disparity in time spans represented by the three major culture historical units easily removes the apparent bias from the sample. To illustrate this point, I have converted the frequencies of components within each period to frequencies per 1000 year interval. Although arguments could be raised as to more appropriate period intervals, the following have been used: the Early Prehistoric Period has been assigned a 3,500 year span (11,000-7,500 years B.P.); the Middle Prehistoric, 5,500 years (7,500-2,000 years B.P.); the Late Prehistoric, 1700 years (2,000-1700 years B.P.); and the

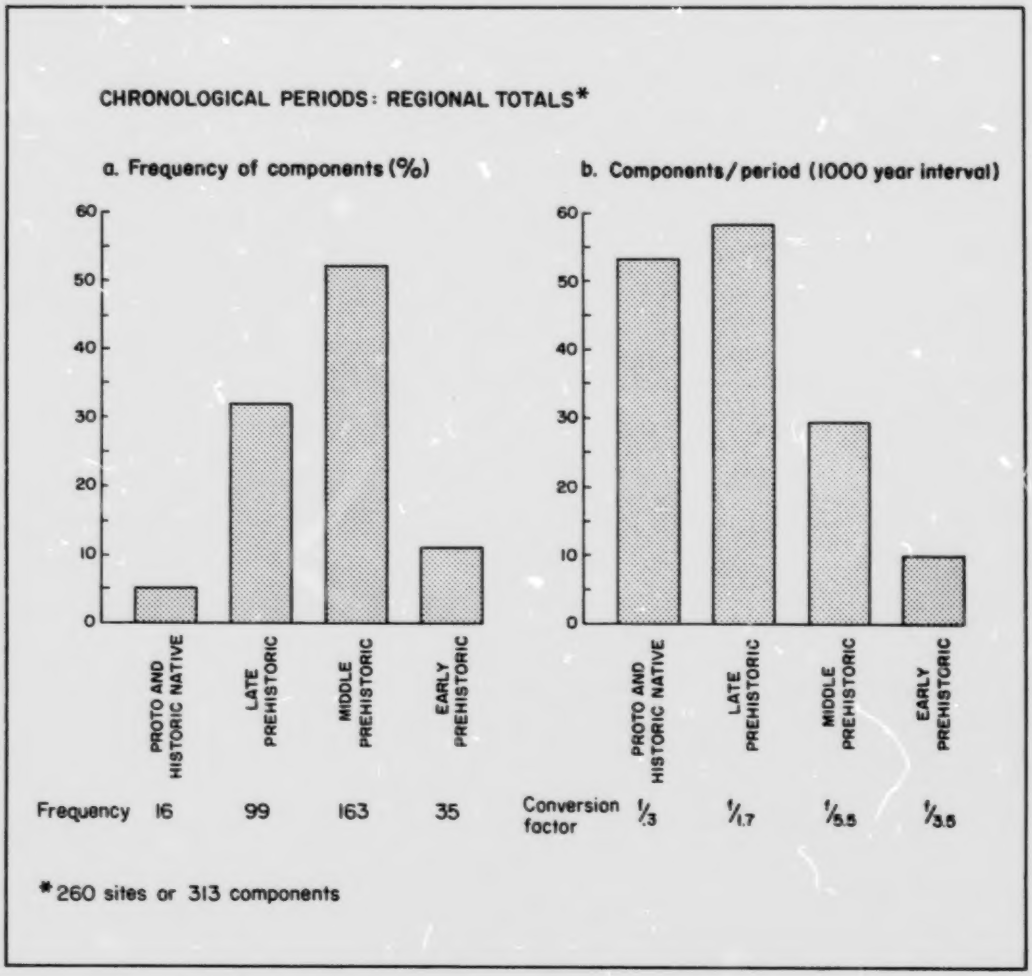

Figure 97. Dated components.

Proto-historic/Historic Native period, 300 years. Figure 97(b) displays the result of this conversion for the region as a whole.

It appears that the number of sites per 1000-year interval steadily increases in time through the prehistoric periods with a slight decrease in frequency during the latest (historic) period. This might be interpreted as representing steady population increase until contact with European culture brought disease and significant settlement pattern shifts; however, a large number of currently uncontrolled factors impinge upon such an interpretation. Significant among these would be site visibility, sample bias, differences in chronological assemblage identity through time, unrecognized variation in populations or site distributions through time, and numerous other possibilities. Analytical isolation of any of these factors and development of testable hypotheses about culture historical processes would be extremely desirable aspects of future research in the region and absolutely essential if large scale regional conclusions are to be seriously offered.

Intraregional comparisons were attempted by separating chronological information by the five major drainage basins. It was found that only the Oldman and Bow river basins provided sufficient sample sizes to allow useful comparisons. Figures 98 and 99 present these breakdowns. Both show a raw frequency prominence of Middle Prehistoric components, but the Bow River basin exhibits a proportionally greater dominance of remains from that period. Both the Late Prehistoric and the Proto-historic/Historic Native periods, in contrast, exhibit lower proportional representation in the Bow than in the Oldman basin. When converted to 1000-year intervals, site frequencies display the same increasing occurrence through time as observed in the regional tabulation, with the exception of the most

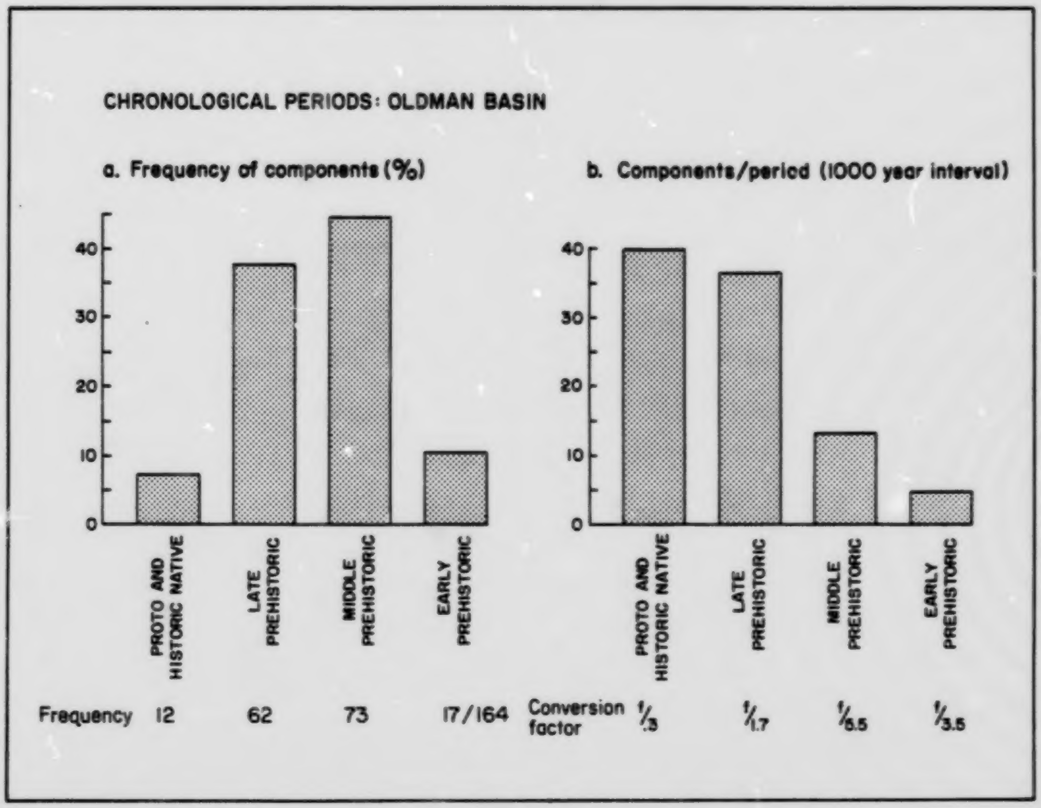

Figure 98. Dated components in the Oldman River basin.

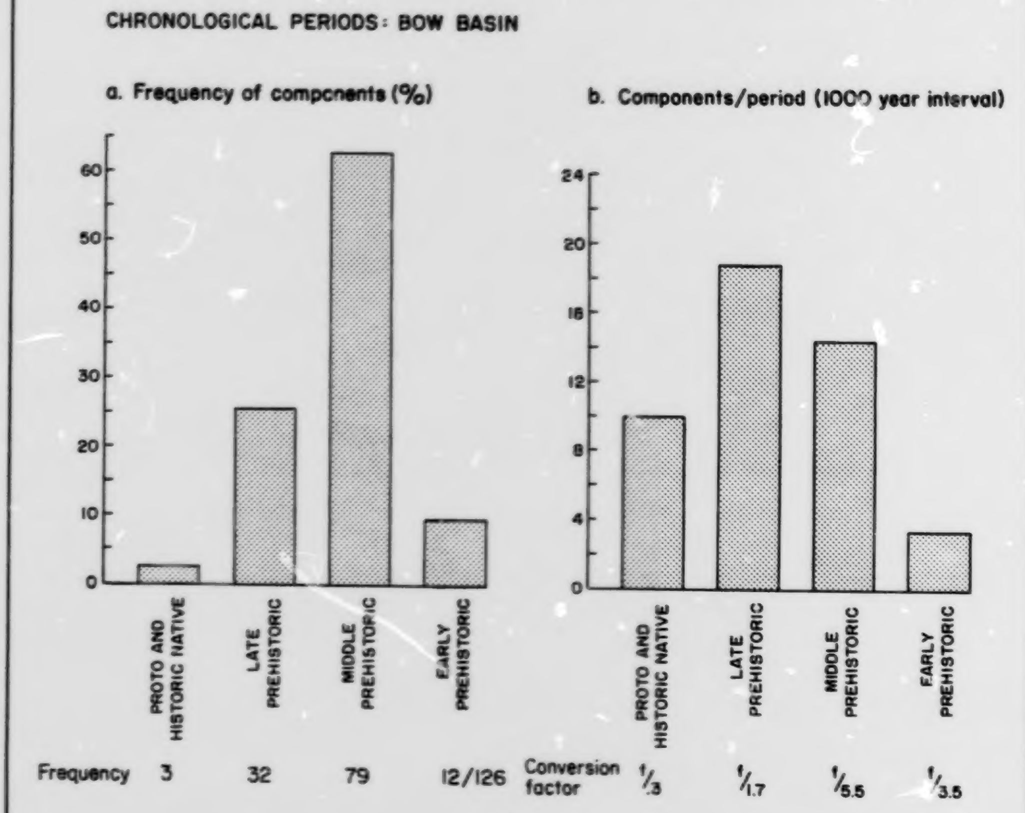

Figure 99. Dated components in the Bow River basin.

recent period where the overwhelming majority of identified sites are located in the Oldman basin. This is interesting, considering that topographic variation and archaeological survey intensities are roughly comparable between these two basins.

The Oldman basin is the most distant area in the province from the initial entry and flow of European goods and influence, thus it is possible that aboriginal settlement patterns persisted longer there than in other areas. The spread of domestic European goods across the southern plains probably occurred faster than other, more disruptive influences, such as disease, alcohol, firearms and Christianity. In a similar fashion, historical factors may have resulted in the retention of a larger portion of pre-contact group structures and beliefs as evidenced by post-contact boulder memorials and burials. Because these statements are made on the basis of very small sample sizes, we have entered the realm of pure speculation and caution is necessary.

North of the Bow River basin, dated components are extremely rare. Only twenty tabulations could be made for the North Saskatchewan, Athabasca and Smoky river basins (see Table 28). Few constructive comparisons can be drawn from such limited data, but the desperate need for comprehensive culture historical research in the northern portion of the region is certainly emphasized.

Table 28. Dated components in northern river basins.

	PERIOD				
	Proto-historic/ Historic Native	Late Prehistoric	Middle Prehistoric	Early Prehistoric	TOTAL
North Sask.	1	0	3	0	4
Athabasca	0	3	8	3	14
Smoky	0	1	2	1	4
TOTAL	1	4	13	4	22

SITE CONDITIONS

Site condition is not a consistently recorded category on the site records. Because the vast majority of sites were identified on the basis of initial surface observations, many researchers were unwilling to comment as to the character of the sites (i.e., surface, buried, stratified). As a result, over 78 percent of the 3,202 sites which could be tabulated are recorded as simply being "disturbed"; 13.8 percent are classified as surface or disturbed surface sites; 6.3 percent are undisturbed or disturbed buried sites; and 2.1 percent are stratified or multicomponent sites. Since the inception of the Historical Resources Act, systematic assessment of site characteristics has been required of sites under threat of impact. Consequently, more recent site records provide better information than the vast majority of existing data. Differences in the condition of sites between the major drainage basins reflect, in large part, existing variations in vegetation and sample sizes. Tabulations for each basin are indicated in Table 29.

With minor exceptions, some general trends are evident from these data. Surface sites show a general decrease in frequency with an increase in density of forest cover and, buried sites, not unexpectedly, generally increase in frequency as environments more densely blanketed in forests are encountered. The significant decrease in stratified sites as one moves north again probably reflects lower levels of deposition in the more stable landscapes of the forested north.

Table 29. Site condition in Eastern Slopes drainage basins.

	CONDITION (in %)			
	Disturbed	Surface	Buried	Stratified
Oldman	70.4	23.4	3.4	3.2
Bow	83.4	8.4	6.9	1.3
North Sask.	92.8	0.8	4.0	2.4
Athabasca	87.3	0	11.9	0.8
Smoky	64.1	2.6	33.4	0

EXPOSURE

The direction a site faces is frequently considered an important locational factor, especially in the northerly latitudes of Alberta (e.g., see Duke 1978). This feature is not part of any of the categories recorded on existing site records and, consequently, had to be inferred from either site location descriptions or mapped locations. For the sake of simplicity, only the four cardinal directions were tabulated.

Of the 3,314 sites on record, facing directions could be confidently identified for only 1764 (53.2%); the balance were considered indeterminate. These latter primarily include sites on level open terrain, exposed ridge tops or inconclusive locations, as well as those for which locational information is so vague as to preclude confident determination of exposure. The frequency of indeterminant assignments may indicate that facing direction was not as critical a factor on a regional basis as some localized studies suggest.

Of those sites for which exposure could be determined, the most common direction on a region-wide basis is south (42.4%); the other three directions had almost equal representation (north 19.6%, east 18.3%, and west 19.7%). Southerly exposures receive the maximum amount of sunlight and are likely to be preferred since they are generally warmer and drier locations, especially during the winter. A wide variety of other factors contribute to a decision as to where a site should be located, and the data base examined here represents, at least to some degree, implicit biases on the part of the field archaeologists as to where to search for sites. These considerations provide little comfort to anyone attempting to make generalizations and suggest that a great amount of caution must be exercised.

Table 30 depicts the relative frequency of facing directions. Facing direction could be established for over half of sites in the Oldman, Bow and Smoky basins but only for about one third in the North Saskatchewan and Athabasca basins. These results may suggest rather extensive use of flat to rolling uplands areas in the North Saskatchewan and Athabasca basins, but the greater intensity of surveys dedicated toward uplands areas and lesser valley systems restrains interpretation of more widely dispersed settlement patterns in these basins.

The distribution of identifiable tabulations does indicate intraregional differences. While south-facing exposures are the most proportionally numerous throughout, their dominance generally increases to the north. On a seasonal basis, there is a full hour of difference in daylight between the extreme northern and southern portions of the region (Government of Canada 1957). This may have had some bearing on site location, particularly in the winter when sunlight is an important component of warmth.

Tipi rings (n=231) have a wide distribution in facing directions; south (31.2%) and east (29.4%) are most common. Cairns (n=93) overwhelmingly face south (49.5%), with other directions almost equally represented (ranging from 15.1% to 20.4%). Rock alignments (n=10), presumably representing drive lanes for communal kills, face almost

Table 30. Facing directions (in %).

	N	S	E	W
Oldman	17.9	33.5	26.8	21.8
Bow	22.2	46.2	12.8	19.3
North Sask.	18.9	59.5	10.8	10.8
Athabasca	9.3	55.8	15.1	10.8
Smoky	13.0	63.0	19.6	4.3
All basins	19.6	42.4	18.3	19.7

exclusively north (40%) and east (50%), as would be expected considering topography and wind direction. Kills (n=15), on the other hand, conform to a lesser degree with the orientations indicated by alignments, facing most prominantly north (37.8%) as would be expected, but secondarily to the west (27%) and south (21.6%). Similarly, jumps and jump complexes (n=20) do not conform in a strict sense with expectations, having predominantly south- (40%) and north-facing (30%) directions; however, these orientations are not inconsistent with prevailing winds (Brink, personal communication 1986).

More generalized site types, such as buried sites, campsites and isolated finds, exhibit exposures which more or less conform with the overall site distribution. This is not surprising considering that these constitute the most numerically frequent types in the classification. Surface scatters, presumably representing small disturbed campsites (n=141), for unknown reasons exhibit an preponderance of south-facing exposures (53.2%) with other directions only minimally represented. This tends to support the interpretation of selective use of south-facing locations. A similar, but slightly more pronounced, distribution is evidenced in the case of workshops (n=50) where southerly exposures (57.1%) dominate all other. Quarry site (n=12) locations are probably conditioned more by bedrock structures and exposures than by any consideration for amenable conditions; however, exposure is commonly southern (41.7%) and eastern (33.3%).

The other types of sites are generally too few in number for instructive comparisons to be drawn. Again, it should be noted that sample bias has probably had considerable effect on the distributions discussed above, but general trends are indicated. Interpretation of such trends must be tempered by the fact that the effects of ecological factors on human settlement systems are best considered in concert rather than individually and on the basis of a systematic and representative sample.

DRAINAGE ASSOCIATIONS AND DISTANCE FROM WATER

Since vegetation zones, exploitable resources, and travel corridors throughout the region are generally distributed in a linear fashion along drainage systems, prehistoric sites may exhibit locational patterning structured by association with the size of drainage system. This feature was tabulated by employing Horton's (1945) system of stream orders, although it should be noted that drainage patterns may have differed to some degree in the past. Using the 1:250,000 scale topographic maps available for the region, each tributary and major drainage was assigned a numerical designation from 1 through 7 (Table 31). First order drainages are the smallest, unbranched tributaries. Second order drainages are formed by the conjunction of two first order streams, and so forth. Seventh order drainages (e.g., Bow, Athabasca) represent the conjunction of two sixth order rivers (e.g., Oldman). An additional category was created for those sites associated with lakes or sloughs.

On a regional basis, 3,252 associations could be recorded (Table 31). A widely ranging pattern of exploitation of various areas within the region is indicated, supporting the argument that the Eastern Slopes region was not merely a travel corridor between two major culture areas.

Table 31. Drainage order associations (in %).

	ORDER							
	1	2	3	4	5	6	7	Lake/Slough
Oldman	22.3	14.1	15.2	18.8	10.5	11.1		7.9
Bow	25.8	15.3	8.6	6.3	23.6	6.8	8.9	4.7
North Sask.	5.6	13.6	12.0	7.2	4.0		51.2	6.4
Athabasca	26.1	2.4	12.2	29.8		0.8	6.5	22.0
Smoky	32.1		6.4	24.4	12.8			24.0
All basins	23.8	13.4	11.7	13.7	15.5	7.7	6.5	7.9

The low percentages of lake or wetland associations reflect the higher numbers of recorded sites in the southern basins where lakes and wetlands are less frequent. Again, it should be noted that climatic changes through time would have undoubtedly affected the size and distribution of wetland areas. Regardless, the respectable presence of wetland associations throughout the area further supports characterization of settlement patterns as wide ranging use of various exploitation zones.

Intraregional comparison of drainage basins provide some interesting results. Both southern basins resemble the regional distribution because of their substantially greater contribution to the sample. The North Saskatchewan basin, on the other hand, demonstrates with emphasis the specific nature of the survey coverage. The almost singular association with the main river itself suggests that our knowledge of hinterland areas in this region is quite deficient.

Both the Athabasca and Smoky (a fifth order river) basins have received more dispersed coverage yet exhibit a substantial difference from the southern basins. Lake and wetland associations account for nearly one quarter of the site samples. It would appear that prehistoric settlement in these basins was centred away from the main corridors along small drainages and near lakes and wetlands areas. Although sample sizes are quite small, a dispersed boreal forest type of economic system is suggested.

As a corollary to drainage order, distance from nearest water source was recorded and tabulated on the basis of site locational information, written description and 1:50,000 scale maps (Table 32). On a regional scale, most sites are located between 100 and 500 m from the nearest drainage. Relatively equal numbers occur between 50 and 100 m and less than 50 m from water. Very few associations occur at distances greater than 500 m but this may in part reflect the restricted nature of the terrain. The need for freshwater by both human populations and the game animals on which they depended is undoubtedly reflected in the general proximity of sites to water. As well, the use of drainage systems as travel corridors contributes to this tendency. However, the preponderance of sites between 100 and 500 m from water suggests that many activities did not require adjacent water supplies and selection of suitable landforms for specific site location superceded the need for water.

Comparison of specific drainage basins with respect to distance from water reveals that an almost identical distribution pattern is present throughout the region. Considering the importance of water to survival, it is suspected that, with the possible exception of the high plains, most other regions in Alberta would produce similar site distributions.

Table 32. Distance from water (%).

	DISTANCE				
	less than 50 m	50-100 m	100-500 m	500-1000 m	1000+ m
All basins	23.5	21.5	44.7	8.8	1.4
Oldman	23.5	21.5	44.7	8.8	1.4
Bow	18.4	17.3	51.2	11.5	1.6
North Sask.	26.8	26.8	35.1	11.3	0
Athabasca	28.6	25.7	40.4	4.5	0
Smoky	38.5	10.3	44.9	6.4	0

TOPOGRAPHIC ASSOCIATIONS

Variation in topographic relief is perhaps the most distinctive feature of the Eastern Slopes and is a major control on resource distribution. Therefore, differential associations between archaeological sites and terrain features may reflect different food resource exploitation patterns. Association with a possible twelve categories of topographic features was recorded for each site for which sufficient information was available. Table 33 displays the distribution of topographic associations on a regional basis and by major basin.

The regional distribution indicates the following patterns: (1) preference for river and stream margins; (2) low occurrence of lake margin and valley bottom locations; (3) considerable preference for river terraces and valley rims; (4) a dominance of rolling uplands associations; and, (5) very few associations with features such as depressions, passes, mountain slopes and ridge tops. This suggests an

Table 33. Topographic Associations (%).

	River Margin	Creek Margin	Lake Margin	Flat Rolling Bottom	1st & 2nd Terrace	3rd & Higher Terrace	Valley Scarp	Rolling Upland	Depression	Pass	Mountain Slope	Ridge Top
Oldman	10.0	21.9	3.7	0.5	14.7	10.3	7.9	26.1	0.5	0.2	2.2	2.1
Bow	2.0	5.9	1.7	1.2	24.9	18.3	10.7	32.2	0.1	1.1	0.6	1.3
North Sask.	50.4	17.1	3.3	2.4	8.1	1.6	1.6	13.8	0.8	0	0	0.8
Athabasca	15.2	24.2	16.8	0	5.3	5.7	3.3	23.8	2.0	0	1.4	2.5
Smoky	10.3	21.8	11.5	2.6	5.1	12.8	5.1	15.3	0	5.1	7.7	2.6
All basins	8.3	14.5	3.9	0.9	18.2	13.3	8.5	28.1	0.4	0.7	1.4	1.7

overall orientation to drainage systems with considerable use of generalized upland areas away from valleys.

Tabulation of major basins provides results similar to some of the other comparisons; that is, both southern valley systems resemble the regional distribution. However, there appears to be more emphasis on river and creek margins in the Oldman basin and greater emphasis on terraces in the Bow basin. The distribution in the North Saskatchewan basin again reflects the character of the survey coverage. The extreme dominance of associations with the main river dwarfs all other associations, but the respectable presence of upland associations suggests that actual distribution may not be that much different from elsewhere in the region.

The two northern basins suggest some differences with the south. Water edge associations, particularly lakeshores, are better represented here than elsewhere. Upland associations are quite high, but much lower use of terraces is suggested, especially along the Athabasca. In the case of the Smoky basin, high elevation sites associated with passes, mountain slopes and ridge tops appear in some frequency.

Interpretation of these results is essentially similar to the drainage order comparisons; that is, while occupation appears to be centred along drainages, the substantial use of upland areas indicates dispersed exploitation zones rather than simply "passing through." The characteristic use of lakeshores and other water margin areas in northern basins suggests greater use of aquatic resources than in the south.

VEGETATION ASSOCIATIONS

The final comparison made here is in terms of site association with vegetation communities, keeping in mind that there may have been considerable vegetational changes throughout the Holocene, including the modern forest management practice of inhibiting fires. Seven categories of vegetation were recorded for those sites for which sufficient locational information exists: riverine, wetland, grassland, montane forest (a parkland-like mix), boreal forest, alpine, and rock (elevations above vegetation level).

On a region wide basis, grasslands are favoured, followed by riverine, boreal forest and montane forest environments, in that order (Table 34). Other categories are only minimally represented. Within major basins, the proportion of forest associations tends to rise to the north, as might be expected, but not with consistency. The distinctive associations of the North Saskatchewan basin reflect the restricted nature of the survey coverage. Only in the Smoky basin do alpine and higher elevation associations constitute a significant proportion of the sample. Their proportionally minimal presence elsewhere probably is a result of very large numbers of sites having been recorded at lower elevations, but their existence indicates high elevation use is a component of exploitation patterns throughout the region.

The absence of grassland association north of the Bow reflects regional vegetation characteristics, while the use of wetlands in the Athabasca and Smoky basins probably reflects both cultural and natural factors. The use of grassland terraces away from river edges appears

Table 34. Vegetation associations (in %).

	Riverine	Wetland	Grassland	Montane	Boreal	Alpine	Rock
All basins	27.7	1.0	32.6	14.1	21.9	1.6	1.0
Oldman	39.6	0.6	38.1	10.8	8.7	1.0	1.3
Bow	9.0	0.3	37.3	20.2	30.6	2.0	0.6
North Sask.	75.2	0.8	0	2.4	20.0	0	1.6
Athabasca	49.8	4.5	0	0.4	44.1	0.8	0.4
Smoky	37.2	11.5	0	17.9	19.2	9.0	5.1

characteristic of the Bow River drainage and somewhat unique to the region. It is believed that this reflects the broadly terraced physical structure of this valley rather than any major cultural differences.

SUMMARY

The foregoing comparisons provide a wide variety of potential interpretations. As noted, many should be considered speculative. Nevertheless, several appear to be worthy of note. Site type distributions suggest that the southern foothills region was part of the Plains culture area for a large portion of the prehistoric record. Within the mountain fronts, the situation is not as clear cut, with possible interior Plateau traits present. In northern areas, the emphasis on upland areas and lakeshore and wetland associations suggest a more dispersed boreal forest type adaptation.

Problems with differential site visiblity aside, the chronological distribution of site assemblages reveals uninterrupted, long-term exploitation of the Eastern Slopes. Between-period comparison appears to indicate a rather steady increase in populations throughout the Prehistoric period with a slight decrease during Proto-historic and Historic Native times.

Site locational decisions appear to reflect a great deal of selectivity in terms of topographic, vegetational, climatic and resource variation, mirroring the environmental characteristics of the region. The use of major valley systems as east-west travel corridors is definitely suggested, but the extensive exploitation of uplands and other areas outside of major river systems demonstrates that the Eastern Slopes functioned as a major exploitation zone rather than simply a travel corridor between the two more well-defined culture areas. The wide variation and distribution of resource areas exploited serve as an indication of the richness and diversity of the prehistoric record in this region of Alberta.

STATUS OF INTERPRETIVE RESEARCH

Archaeological reports almost invariably contain interpretive sections but few provide statements of an integrative nature, relating specific findings to larger issues with historical or behavioral implications. However, several published and unpublished studies are available for the Eastern Slopes region which attempt more synthetic statements. This section will discuss the nature of the arguments presented in some of these and will offer some commentary on the status of research in the region.

OVERVIEWS

Overviews sometimes are done as the first step in the HRIA process and involve assembling relevant, previously collected information and suggesting areas of high potential for sites. Studies of this nature are relatively rare in the Eastern Slopes region but include Reeves and Hanna's (1982) overview/inventory on the proposed Weasel Valley reservoir on the Peigan Indian Reserve along the Oldman River west of Fort Macleod and Balcom et al.'s (1984) review of expected settlement patterns in the areas to be developed for the 1988 Olympics in the Kananaskis region east and south of Banff National Park. Only the latter study provides a relatively detailed model of terrain use, and neither have comparative or region-wide implications.

Two academic reviews published by Reeves (1974d, 1981) constitute the only region-wide overviews available. Both articles review previous studies and discuss archaeological potential in various parts of the region. The 1974 study describes roughly similar settlement pattern models for Banff and Waterton parks, indicating year round use of localized environmental resources. It concludes with the contention that the Alberta Rockies should be considered a separate culture area from either the Plains or the Plateau (Reeves 1974d:21). While this concept remains to be demonstrated with the information available to date, it has major implications as an organizing device for archaeological interpretation in the region.

CHRONOLOGIES

The development of regional chronologies is the critical first step to more detailed archaeological understanding of any area. A number of chronologies have been developed using data obtained in the Eastern Slopes, and most have been expanded for use elsewhere, particularly on the plains. Vickers (1986) has provided a detailed review of the issues surrounding various Alberta chronological systems pertinent to the plains. The reader is urged to consult that source for more detail than will be presented here. The structure of the following discussion reflects the historical development of archaeological studies in Alberta.

Late Prehistoric Period

Forbis's (1962) excavations at Old Women's Buffalo Jump resulted in a point typology based on metric attributes and seriation. This typology defines the development of the Late Prehistoric Old Women's Phase from Middle Prehistoric antecedents around A.D. 600 and lasting to around A.D. 1700. The presumed developmental continuity of the phase and its terminal identification with the historic and proto-historic Blackfoot in the region contradicts some interpretations of early historic records which suggest that the Blackfoot are relatively recent arrivals in the region (see Brink 1986). Although its antecedents are not yet entirely clear (see Vickers 1986 for discussion), Old Women's Phase would appear to be a viable chronological unit for large portions of the southern Alberta foothills. It should be noted, however, that most Alberta archaeologists no longer apply the fine distinctions resulting from Forbis's typology, commonly opting for more inclusive terms such as Late Plains Side Notched when discussing projectile point morphology.

Inside the mountain fronts, the situation is far less clear and is complicated by the co-occurrence of a chronological/cultural unit known as the Tobacco Plains Phase (Loveseth 1980; Kennedy et al. 1982; Reeves 1978b, 1980, 1983). This phase supposedly represents the Rocky Mountain trench temporal equivalent of Old Women's Phase and is thought to be directly ancestral to the historic Kutenai.

Byrne's excavations at the Morkin site at the edge of the Porcupine Hills in the Oldman River basin prompted an exhaustive consideration of

Alberta ceramic assemblages (Byrne 1973). While the chronology relates primarily to the plains, several sites in the southern part of the Eastern Slopes contributed to its formulation. Two major ceramic traditions are recognized: the Saskatchewan Basin Complex and the Cluny Complex (Byrne 1973). The former is seen as an indigenous development on the plains consisting of two chronologically sequential variants, early and late. The early variant is associated with the Avonlea Phase of the early portion of the Late Prehistoric Period, and the late variant is associated with the Old Women's Phase. Although it cannot be demonstrated at this point, Byrne (1973:558) feels that ceramic technology came from the east and, in agreement with Reeves (1983), suggests that bow and arrow technology had a western, mountain origin (Byrne 1973:459). While Avonlea Phase extends well into the mountains and Rocky Mountain trench area (Reeves 1978b, 1983), it appears that its ceramic component is limited to the foothills of the front ranges (but see Kennedy et al. 1986). Whether this suggests within-phase cultural differences or other differences is open to question.

The Cluny Complex is considered intrusive in southern Alberta and is thought to represent a physical migration of a group culturally distinct from resident Old Women's Phase populations. This is suggested because the ceramics show relationships to Middle Missouri types (Byrne 1973:471ff). This presence in southern Alberta is termed the One Gun Phase (A.D. 1720-1750) (Byrne 1973:531) and is represented at the Cluny site, a unique fortified earthlodge village on the lower Bow River (Forbis 1977), and possibly at the Morkin site on the edge of the Porcupine Hills (Byrne 1973:503). The relatively rare occurrence of Cluny Complex ceramics in the South Saskatchewan basin, including portions of the foothills, is probably the result of diffusion. Vickers suggests the possible assimilation of One Gun immigrants into Old Women's Phase groups after abandonment of the Cluny site (Vickers 1986). Its short duration, localized distribution, and strictly Plains orientation suggests that the One Gun Phase probably had limited impact on Eastern Slopes prehistory.

Late Middle Prehistoric Period

The most comprehensive and wide ranging chronological formulations for this period have been those by Reeves. Research he conducted during the period 1966 through 1972, to complete his doctoral studies at t University of Calgary, resulted in a detailed synthesis of information from a wide area of the Northern Plains for the time period from 1000 B.C. to A.D. 1000 (Reeves 1983).

Reeves groups the grassland foothills zone of Alberta (up to the front ranges) with the plains, and defines two major cultural traditions for the region, Tunaxa and Napikwan, the temporal and spatial dimensions of which characterize the Late Middle Prehistoric Period in the area. These traditions consist of serial, culturally linked phases which possess distinct, areally extensive trait similarities. The Tunaxa tradition consists of the earlier McKean and Hanna complexes, Pelican Lake Phase and Avonlea Phase; Napikwan consists of Besant Phase and Old Women's Phase (Reeves 1983:135-193). Reeves' use of the term phase is an abstraction of Willey and Phillips' (1958:72) concept (i.e., a unit possessing sufficiently distinctive characteristic traits), by considering it not necessarily tied to any particular locality or region (Reeves 1983:39). The rather comprehensive comparison of various cultural and technological traits ("subsystems") used by Reeves to define phases is a laudable technique not usually present in most similar studies.

Inclusive Chronologies

In developing his first explication of a temporally extensive chronology for Alberta, Reeves (1969) rejects Wormington and Forbis's (1965) terminology by following Mulloy's (1958) divisions of Early, Middle and Late Prehistoric. Using data accumulated by University of Calgary researchers, he developed a sequence which he believes applies strictly to the plains, although the bulk of the Alberta data are derived from the southern foothills. Changes from the earlier formulation by Wormington and Forbis (1965) include:

- more detailed characterization of the Early Prehistoric Period (Clovis Complex 10,000-9,000 B.C.; Folsom Midland Complex 9,000-8,500 B.C.; Agate Basin-Hell Gap Complex 8,500-7,500 B.C.; Alberta-Cody 7,500-6,500 B.C.; Lusk and Frederick complexes 6,500-5,500 B.C.);
- addition of the Mummy Cave Complex (5,500-3,500 B.C.) to the Early Middle Prehistoric; and

- characterization of the Late Middle and Late Prehistoric periods by the Tunaxa and Napikwan Traditions (Reeves 1969:33-37, 1983; also see Vickers 1986).

Environmental changes are offered as a possible explanation for some of the changes in cultural expressions noted (Reeves 1969:29).

Reeves typically uses the term subphase to indicate local expressions of the larger unit. This terminology is applied to summary descriptions of the chronology of his first major study inside the mountain fronts, that is, in Waterton Lakes National Park (Reeves 1972a). The prehistory of this area is believed to be "characterized throughout by successive cultures of nomadic communal bison hunting peoples adapted to seasonal exploitation of small herds of bison in a mountain environment" (Reeves 1972a:133). Subphases and relationships are shown in Table 35.

Reeves (1972a) attempted subphase comparisons between material recovered in Waterton Park and adjacent areas of the plains and mountainous west, although at not as detailed a level as in his dissertation. Associations, therefore, are somewhat less strongly based. The study, however, is a landmark and one which set both the interpretive tone and the format for much of the subsequent work in the region.

Apparent differences with the phase expressions formulated on the plains were noted. These include undefined similarities with the Windust phase of the lower Snake River, Washington (Leonhardy and Rice 1970; Rice 1972) in the earliest occupations in Waterton; the relationship of the Red Rock Canyon subphase to the Mountain/Plains culture (Swanson 1962) of Idaho; and the persistence of Mummy Cave Complex in the mountains, while the plains area strongly diverges through Oxbow and McKean complexes. While much of the rest of the sequence largely resembles that on the plains, Avonlea is also strongly represented east of the divide.

In subsequent papers, Reeves has modified and expanded this model to cover more northerly areas. Before these modifications are discussed, it is necessary to review the only other comprehensive subregional chronology developed for the Eastern Slopes. Driver (1978c) reviewed the substantial amounts of new information resulting from research and management-oriented studies conducted during the 1970s in the Crowsnest Pass and developed a chronology based largely on Reeves' model. Because

Table 35. Pass Creek Valley (Waterton) chronological sequence (after Reeves 1972a).

PERIOD	SUBPHASE		POINT TYPES	RELATIONSHIPS
Late	Pass Creek Valley	(A.D. 1200-1800)	Plains side notched, Plains triangular etc.	Old Women's
	Crandell Mountain/ Waterton River*	(A.D. 400-1200)	Avonlea, Timber Ridge, Samantha*	Avonlea Besant
Late Middle	Besant*	(A.D. 1-400)	Besant*	Besant
	Blue Slate Canyon	(1500-1000 B.C.)	Pelican Lake	Pelican Lake
	Blackiston Brook	(1000 B.C.-A.D. 400)	Hanna	Hanna
Early Middle	Bellevue Hill	(5500-1500 B.C.)	Bitterroot, Salmon River etc.	Mummy Cave Complex
Early	Valley Entrance	(6000-5500 B.C.)	Lusk	Lusk Complex
	Red Rock Canyon	(7000-6000 B.C.)	Agate Basin, Lusk Lerma: Scottsbluff	Mountains/Plains culture
	Lake Linnet II	(7500-7000 B.C.)	leaf shaped	Lerma
	Lake Linnet	(8000-7500 B.C.)	stemmed lanceolate	Windust

*poorly represented

the emphasis of this study was more toward economic than historical analysis, phase linkages were based even less on inclusive subsystem comparisons than Reeves' Waterton study. The sequence uses named subphases in a highly localized sense (following Reeves) but identifies external relationships only on the basis of projectile point stylistics (Table 36).

Although Driver eschews reliance on stylistic analysis of projectile points as a mechanism for defining cultures (Driver 1978c:95, 108), it is exactly this technique he employed within the study area. With the exception of Reeves' (1983) dissertation, this is the common practice among most archaeologists in the region. Driver would prefer, however, to see stylistic similarities in projectile points over broad areas explained in terms of participation in wide ranging information systems "which may well have transcended the boundaries of individual cultures" (Driver 1978c:120).

It is in this latter fashion that Driver discusses external relationships between the Crowsnest sequence and other areas. These essentially follow Reeves and speculate that information flowed westward to the Columbia Plateau in the earliest period (ca. 8,000-7,000 B.C.) and along the mountain fronts in the later part of the Early Prehistoric Period (ca. 7,000-5,500 B.C.). Information is believed to have flowed across the plains, mountains and plateau initially during the Early Middle Prehistoric Period (5,500-1000 B.C.) with a later dramatic decrease in plains influence, and later between the mountains and plains during the bulk of the Late Middle (1000 B.C.-A.D. 450) and Late Prehistoric (A.D. 450-1850) periods. There had been presumably a general exclusion of Besant from the mountains.

A terminal Late Prehistoric tie to the historic Kutenai, while only hinted at by Driver, is given better footing by Loveseth (1980) in her analysis of the sequence from the Dancehall site at the head of the Crowsnest Pass. Differences she noted between Old Women's Plains occupations and the Frank and Crowsnest occupations include a more diversified economy, use of fish as a food resource, absence of pottery, relative absence of pebble tools and, in particular, predominant use of material from a traditional Kutenai quarry west of the divide known as Top-of-the-World chert (Loveseth 1980: 204). A similar cultural

Table 36. Crowsnest Pass chronological sequence (after Driver 1978c).

PERIOD	SUBPHASE	POINT TYPES	RELATIONSHIPS
Late	Crowsnest Lake (A.D. 1050-1850)	Plains side notched	Kutenai (?)
	Frank (A.D. 450-1050)	Avonlea	Avonlea (?)
Late Middle	Burmis (1000 B.C.-A.D. 450)	Pelican Lake, Hanna Kootenay side notched, Pass Creek, some Besant	Pelican Lake
Early Middle	Maple Leaf (5500-1000 B.C.)	(late) Bitterroot, Oxbow, McKean, Elko eared, Duncan, Hanna, Pelican Lake, Pass Creek	Mountain forms(?)
		(early)Bitterroot, Oxbow	Mummy Cave
Early	Ptolomy (7000-5500 B.C.)	Agate Basin, Pryor Stemmed	Mountain forms (Plains/Mountain)
	Livingstone Complex (8000-7000 B.C.)	Lovell Constricted, Lusk Humbolt Concave and Stemmed	Windust

ascription is made by Kennedy et al. (1982) in analysis of the final occupation at DjPq-1 immediately west of the Crowsnest Pass.

These last two studies summarize excavations at two deeply buried sites repetitively occupied over the majority of the Prehistoric Period. Both employ Driver's localized subphase terminology, and both draw external phase relationships following Reeves' Waterton model. A consistent chronological interpretation is therefore presented for the upper Oldman basin.

North of the Oldman basin no true chronologies exist. At the Sibbald Creek site, Gryba found a series of point types indicating relatively continuous occupation beginning possibly as early as 11,000 years ago (Gryba 1983:159). The point styles were distributed in only roughly chronological fashion throughout a scant 45 cm profile and, since attempts to date the site have been problematic, no detailed synthesis can be conducted (Gryba 1983:123). Nevertheless, a sequence not unlike those to the south is suggested (Gryba 1983:Figure 79). Major differences include the absence of Bitterroot/Salmon River styles at the beginning of the Middle Prehistoric Period (Gryba uses the Early Plains Archaic terminology) and, instead, the presence of types stylistically similar to Mount Albion points (Benedict and Olson 1978) in the Colorado Rockies. Another difference is the absence of Avonlea-linked types in the Late Period with a corresponding rather strong Besant presence.

Elsewhere in the Bow basin, a long sequence has been recovered at the Vermilion Lakes site in Banff Park (Fedje 1984, this volume). With basal dates around 10,500 years B.P., this is one of the oldest sites in Canada. Although the earliest occupation remains undefined, Plains/Mountain Complex, Early Mummy Cave Complex and Avonlea Phase occupations have been identified.

In an unpublished, but often cited paper presented at the 1978 Plains Conference, Reeves summarized the sequence for the entire region and speculated as to its relationship to the plains. He suggests that, at some intervals, related cultures occupied both plains and mountain environments and, at other intervals, cultural boundaries seemed distinct between the two areas. These differences are seen to correlate with periods of environmental change but are believed to result from a complex series of interrelated cultural factors as well. We will return to these arguments shortly, but for the present I have summarized the cultural/historical relationships that Reeves proposes in Figure 100.

North of the Saskatchewan basin, the situation is relatively unknown. The general indications are that the Early Period includes Clovis to Agate Basin-like lanceolates, the Middle Period contains late Mummy Cave, Oxbow and McKean-like varieties and the Late Period is represented by a variety of Boreal Forest Complex types as yet undefined. I would echo Reeves' cautions that these scenarios are speculative. The validity of any regional chronology rests on a series of well-described, firmly dated assemblages from stratigraphically distinct sites. In the absence of detailed assemblage comparison, relationships can only be drawn when consistent typological assignments can be made. In both these regards, many of the components comprising subphase descriptions in the southern portion of the region suffer to some degree. For example, neither the earliest Lake Linnet Complex in Waterton nor its equivalent Livingstone Complex in the Crowsnest have associated radiocarbon dates. When Driver presents the dates associated with the early Maple Leaf (Mummy Cave) subphase, three of the eight fall outside the expected range and, of the remaining five, only two actually date diagnostic materials (Driver 1978c:100-101). Similarly, four of the eight dates supplied for the Burmis subphase fall outside the expected ranges.

These problems hint at some of the stratigraphic and preservation problems which exist in the region. At key sites, for example, components are frequently described as containing an unexpectedly wide variety of point styles. For instance, component 3 at DjPq-1, associated with the later Early Mummy Cave Complex, contains Avonlea, Pelican Lake, Hanna, Oxbow, Bitterroot, Salmon River, Lusk and Agate Basin styles (Kennedy et al. 1982:55). At the Dancehall site, Bitterroot style points, characteristic of the Early Middle Prehistoric, occur primarily in Late Middle Prehistoric components and even in the Late Prehistoric component (Loveseth 1980:Table 4). Similar mixing is evident in the early component at DjPn-9 (Quigg and Reeves 1975). While such problems do not characterize the entire data base and do not necessarily invalidate the chronologies developed, they do point out that either the data or the subphase concepts are less than precise.

Figure 100. Comparative chronological sequences.

	SOUTHERN MOUNTAINS		PLAINS
(A.D. 900-1850)	Tobacco Plains		Old Women's
(A.D.200-400-900)	Avonlea	↔	Avonlea
			Besant
(1500 B.C.- A.D.200-400)	Pelican Lake/Tunaxa	↔	Pelican Lake
(3000-1500 B.C.)	Late Mummy Cave		Oxbow, McKean
(5700-3000 B.C.)	Early Mummy Cave	↔	Mummy Cave
(7500-5700 B.C.)	Plains Mountain	↔ ↘	Lusk/Frederick
			Cody Complex
(8500-7500 B.C.)	Windust/Old Cordilleran	↘	Agate Basin/Hell Gap
(10,000-8500 B.C.)	Clovis	↔	Clovis, Folsom, Plainview

↔ = relationships

Typological cross dating and development of external relationships present their own form of problems. Reeves (1975) sees similarities in the large stemmed points found in his earliest components to Windust Phase (Rice 1972) materials and Old Cordilleran materials known from the lower Snake and Columbia Rivers (Butler 1961). The time span of various large lanceolates in the Plateau is not well understood and some may persist quite late (e.g., Swanson 1972). As well, published data from intervening areas are extremely sparse. Driver's earliest Livingstone subphase lanceolate forms are said to resemble Humbolt Concave and Stemmed forms and date around 8,000 B.C. (Driver 1978c:97). Dates on the Humbolt series in the Great Basin have been reported to vary from 3,920 to 1100 B.C. (Taylor and Meighan 1978:156).

Accumulating data in the area suggest that the point styles characteristic of the Early/Middle Prehistoric transition are not fully appreciated (Gryba 1983; Ronaghan 1985). Furthermore, Reeves (1983), in an updated introduction to his dissertation, decries the common practice of ascribing relationships between southern point styles and northern assemblages.

In summary, chronologies are nonexistent north of the Bow corridor and this lack represents a major knowledge gap. Those developed in the south, particularly in the Oldman basin, are reasonably well defined but do not have as precise a basis as could be hoped. Perhaps least well understood are the earliest occupations. Despite the amount of work undertaken to date, no definite evidence of initial peopling of the New World along the Eastern Slopes has been discovered. Although somewhat weak evidence is available, it would appear that, at least for certain periods of time, the occupations in the area were distinct from those on the plains. In part, Reeves' (1974d) contention that the Eastern Slopes represent a distinct culture area can be argued on this basis.

SETTLEMENT PATTERN MODELS

What initially appears to represent stratigraphic problems resulting in an unexpected mix of projectile point styles may actually represent long-term continuity of occupation and persistence of certain point forms. Driver's consideration of the repetitive nature of occupation, land and resource use suggested that "there is considerable stability in patterns over the last 8,000 to 10,000 years of Crowsnest prehistory" (Driver 1978c:155). Reeves had come to a roughly similar conclusion in consideration of the Pass Creek (Waterton) data: "the resource and land utilization patterns as they appeared in different parts of the valley ... have remained essentially stable for the last 8,500 years" (Reeves 1972a:129). Both authors have attempted to define land/resource use patterns which characterize occupations in each valley. These models incorporate the following evidence: site functional information derived from excavation; chronological variation derived from radiocarbon dates and typology; seasonality estimates based on recovery of foetal ungulate elements, migratory fowl, or aquatic specimens from archaeological sites; and seasonal terrain suitability assumptions.

In a smaller regional study, Quigg (1974) used similar, if slightly less detailed, categories of information to describe a seasonal use pattern for the Belly River in the foothills zone adjacent to Waterton Park. In areas further north, attempts have been made to outline possible settlement pattern models for major mountain valley systems but only on the basis of limited surficial observations and terrain assumptions (Anderson and Reeves 1975; Christensen 1971).

Because the patterns in all areas generally involve nomadic hunters, whose main mechanism of survival was exploitation of big game animals, all of the settlement patterns advanced are intimately tied to the seasonal movement patterns of the ungulates present in the area. In the southern part of the region, bison movement patterns were the major determining factor. Further north, a wider variety of species appeared to have influenced settlement patterns, although almost no data are available regarding subsistence.

Table 37 summarizes seasonal settlement patterns described for the Belly River, Waterton, Crowsnest, Banff and Jasper areas. Quigg's Belly River data (river bottom campsites and kills) suggest principal use of the area during winter when plains bison herds sought shelter in wooded foothills valleys (Quigg 1975:33). Tipi ring sites are located along the rims of the valley, suggesting, by their exposed locations, that some occupations occurred in a season other than winter. Subsistence during

Table 37. Proposed seasonal movement patterns.

	Winter	Spring	Summer	Fall
BELLY	camps on east side of valley bottom; kills on west side (snowdrifts and jumps); primarily bison (bulls and cows), other species minimally represented	tipi rings on valley rim suggest season other than winter		possible commural drives of cow-calf herds
WATERTON	large camps on valley floor; communal and individual hunting of bison in foothills	small hunting camps in higher valleys, some use of fishing stations	small hunting camps in cirques and either larger base camps on upper valley plain, or fragmented groups at higher elevations	large campsites on valley floor; communal and individual bison hunting in foothills
CROWSNEST	camps at east end of Pass and foothills; primary exploitation of bison, presumably communally or individually	interception of bison herds migrating west and up tributary valleys; sites on high terraces	large base camps at west end of Pass where multiple zones and species are exploited (fish, plants, various ungulates)	interception of bison herds migrating eastward and down tributary valleys; sites on high terraces
BANFF	valley floor and lower subalpine camps; exploitation of large ungulates	multiple and limited activity sites in lower subalpine; dispersal of hunting forays as ungulates move upward; some plant collecting	hunting in alpine residence in middle subalpine; plant collecting	large camps in middle subalpine; hunting and ranging for berries at treeline
JASPER	low valley occupation		high valley occupation	

the warmer season probably involved widely dispersed bison hunting on the surrounding plains (Quigg 1975:34).

In Waterton, Reeves (1974d) suggests a pattern of site location structured on the altitudinal seasonal migration of bison. Lower valley use is indicated during winter, when plains and local herds sheltered in the foothills. Migration through the upper valley plain to high elevation cirques occurred during warmer seasons, with a subsequent descent in fall (Reeves 1970:Y4-8). With this model, Reeves has described a possible year-round adaptation to a single valley system. He feels, however, that it should more "probably be considered only part of the total home range" (Reeves 1970:Y4-8).

Driver's (1978c) "herd hunter model" is the most detailed and inclusive developed to date. It relates to the 30 kilometre long Crowsnest Valley and recounts a potential seasonal settlement pattern structured by bison movements, both in elevation and along the length of the valley. Like the Waterton example, wintering herds were exploited from low terrace campsites at the foothills (east) end of the pass.

Migrating herds were intercepted from high terrace mid-valley sites in spring and fall. Summer was spent in lakeside camps in the upper valley from which a wide variety of ecozones and their resources could be exploited (Driver 1978c:130ff). Again, possible year round exploitation of a single area is suggested. As with Reeves, Driver (1978c:164) cautions that the model is only one of a number of possible reconstructions.

Models suggested for Banff (upper Bow basin; Christensen 1971) and Jasper (upper Athabasca; Anderson and Reeves 1975) are not based on excavation results and are therefore more hypothetical but reflect similar elevationally structured seasonal patterns. The rigid seasonal structuring of environmental characteristics in the region offers little other option for extensive hunter-gatherer exploitation than the basic aspects of the models suggested. These models provide, first, an indication that almost all environmental zones in the region were exploited seasonally by prehistoric groups. Second, and most important, they provide some detail about the expected characteristics of the residue of this exploitation as conditioned by different topography and varying resources. The variety of terrain-influenced models provides several alternatives against which to measure actual site distributions in other valleys and thereby refine our knowledge on the regional scale. Reliable patterns can only be suggested, however, when detailed knowledge regarding subsistence, site function and seasonality of occupation are available. Only the Belly River, Waterton and Crowsnest models employ this type of information, although significant weaknesses are present even in them.

MODELS OF CULTURAL RELATIONSHIPS

Perhaps the most hypothetical aspect of the settlement models is the linking of identified seasonal occupation variation into a "round" presumably undertaken by a single resident population. As previously noted, Reeves and Driver do not consider the patterns they observed to be necessarily the product of a single resident cultural group nor do they feel the suggested round took place on a yearly basis.

Duke's (1978) research examined in detail the microtopographic/site co-associations during the Burmis subphase (Pelican Lake Phase) in the Crowsnest Pass. Besides recognizing a number of structured environmental factors contributing to site locational decisions, he suggests several alternative hypothetical cultural use patterns to explain site seasonality and lithic source material distribution (Duke 1978:93-95). Paraphrased, these are:

- Single group occupation with seasonal movement between the east and west ends of the Pass and well developed external trade networks to explain the high percentages of imported stone.
- Primary occupation of summer season sites east of the divide by groups whose wintering grounds were located in the Rocky Mountain trench area. This conforms with ethnographically suggested Kutenai seasonal cycles and explains the presence of interior B.C. stone in the area.
- Occupation of the wintering sites at the east end of the pass by Plains groups following bison herds to this area. This conforms to movement patterns described for several historic Plains groups (e.g., Wedel 1963). Penetration of the mountain ranges is not part of this pattern.
- Exploitation of the Crowsnest by groups engaged in wider movement patterns throughout the Eastern Slopes. This would also explain the wide variety and distribution of imported stone materials.

The veracity of any of these possible use patterns requires extensive detailed testing and may be beyond the current capability of both the data and our analytical techniques. Consideration of such questions is important both for understanding the cultural dynamics of the area and for evaluation of the suggestion (Reeves 1974d:21) that the Eastern Slopes be considered a culture area separate from the Plains or Plateau.

These considerations formed the basis for the design of a recent conservation-oriented study conducted by Fedirchuk, McCullough and Associates Ltd. on four sites in Sheep and Elbow river valleys of the upper Bow basin (McCullough and Fedirchuk 1983). Differences between these sites and those on the nearby northern plains suggest complex cultural relationships. Several alternative "hypotheses" regarding prehistoric adaptive strategies on a subregional basis were offered using inferences from ethnographic and historic records as well as conjecture

(McCullough and Fedirchuk 1983:51ff). These alternatives were advanced as follows:

Hypothesis No. 1 - The Upper Bow River Drainage Basin formed a part of the exploitive range utilized exclusively by a Plateau culture group.

Hypothesis No. 2 - The Upper Bow River Drainage Basin formed a part of the exploitive range utilized exclusively by a Plains culture group.

Hypothesis No. 3 - The Upper Bow River Drainage Basin formed a part of the exploitive range utilized by Plateau and Plains culture groups during alternate seasons.

Hypothesis No. 4 - The Upper Bow River Drainage Basin formed a part of the exploitive range used jointly by both Plains and Plateau culture groups.

Hypothesis No. 5 - The Upper Bow River Drainage Basin formed part of an exploitive range which was utilized exclusively by a cultural group adapted to the Eastern Slopes.

Hypothesis No. 6 - The Upper Bow River Drainage Basin formed a buffer zone between Plains and Plateau culture groups (McCullough and Fedirchuk 1983:53-59).

Each of these hypotheses was framed with several test implications which are not reproduced here for brevity sake (see McCullough and Fedirchuk 1983). Primarily they involve recognition of cultural material traits and exploitive patterns indicative of Plateau, Plains or Eastern Slopes cultural groups. Making confident inferences regarding the ethnicity of prehistoric groups on the basis of their material remains is fraught with difficulties. Nevertheless, the above hypotheses are reproduced here primarily because they represent the only formulation of this nature offered as yet for any research in the region. As well, they are sufficiently general to have potential application throughout the southern portion of the region where the plains are adjacent. Substantial modification would be necessary to generate similar hypotheses in the north, where the adjacent lowlands would have undoubtedly supported adaptations to a boreal forest environment.

It was hoped that recovery and analysis of information from the four sites investigated would support one of the alternative patterns. Practical difficulties, involving compressed and somewhat mixed stratigraphy, as well as a scarcity of highly distinctive culturally diagnostic items, precluded firm assignment of cultural affinities. As recognized by the authors, several more intractable problems are present at theoretical levels (McCullough and Fedirchuk 1983:247). The first problem relates to the validity of drawing equivalences between archaeological phases/subphases and historically recognized ethnic groups. Even if the assumption of equivalence is accepted, a second problem exists in commonly incomplete material culture phase descriptions such that ethnic identification cannot be confidently made on the basis of comparison of reported assemblage descriptions. Outside of the Late Middle Prehistoric Period (Reeves 1983), comprehensive phase descriptions do not exist in Alberta and very little information is available from the Rocky Mountain trench to the west. Considering the present status of the regional data base, it is doubtful that effective external comparisons can be made without considerable collections reanalysis or new information.

Giving consideration to questions of this nature is important, however, because they indicate productive directions for future research into the nature of cultural change in the region. Establishment of trait constellations, which might be indicative of ethnicity, is the basic requirement for assessment of questions at the level of culture areas. Whether these requirements can be met in the near future is questionable, but productive investigation of culture change in the region need not be confined to issues of ethnicity. Changes in patterns of subsistence, technology and exchange networks are also worthy of inquiry and involve less contentious theoretical issues. However, problems with the resolution of the data and obtaining concensus among archaeologists with respect to meaningful comparable classification categories will inhibit resolution of such questions.

Processual Models

Only one formulation exists in the region which could be considered to involve the process of cultural change. Reeves (1978b) has developed a cultural historical model attempting to characterize the cultural interplay in the region throughout the Prehistoric Period. It is a direct outgrowth of his consideration of the phase relationships in the Late Middle and Early Late Prehistoric periods on the plains (Reeves 1983) and the mountain data as revealed in Waterton (Reeves 1972a) and the Crowsnest (Driver 1978c). The phase relationships are presented in Figure 100.

The model is highly speculative in nature and probably overly simplistic, shortcomings of which Reeves is entirely cognizant. Nevertheless, it represents a model against which new information can be measured and which can be modified as required. As previously discussed, the model is characterized by alternating situations where, at one time, both plains and mountains are occupied by the same culture and, at other times, there is a sharp cultural division between the two areas (Figure 100). His basic arguments as to causal factors for these different situations follow both environmental and cultural lines.

Environmentally, the mountains provided a wide variety of faunal and vegetal resources, thereby favouring broadly based adaptive strategies. The plains, on the other hand, were less environmentally diverse and favoured specialized bison-hunting adaptations. During periods of aridity, grassland expansion into the mountains is believed to have occurred, permitting intrusion of specialized bison hunters into the mountains where they quickly adapted to the varied mountain habitats and eventually displaced or absorbed indigenous groups. This is hypothesized to have occurred during periods represented by the Plains/Mountain Complex, early Mummy Cave Complex and Pelican Lake Phase.

During climatic periods characterized by cooler and wetter conditions, it is hypothesized that specialized bison hunters could not be as easily supported, and more broadly based adaptations could expand onto the plains. A cited example of this situation is the return of unstemmed lanceolates (Lusk, Frederick) to the plains during the proposed Pinedale IV glacial advance, displacing the Cody Complex (Reeves 1978b). The environmental bases for these changes must be considered hypothetical until empirical evidence verifies their magnitude and effects. However, given that during certain periods environmental change does not occasion replacement or replacement is seen to occur without environmental change, adequate explanations require more complex cultural factors. Reeves (1978b) characterizes these cultural factors in terms of differences between the two adaptive strategies. Mountain adaptations are conceptualized as being flexible in coping with environmental stress but culturally conservative and resistant to change (Reeves 1972a). This latter feature is given as the reason why Plains/Mountain groups resisted Cody intrusions, why Mummy Cave Complex resisted McKean expansion, why Avonlea Phase resisted Besant Phase occupancy of the mountains, and why the Tobacco Plains Phase did not permit Old Women's Phase incursion beyond the foothills.

Although not explicitly stated, a major basis for this model is the concept that the archaeological phase is equivalent to a cultural group. Reeves' chronologically limited dissertation research presented strong arguments in support of this view by extensive comparisons over broad areas. For the bulk of the sequence, however, this has not been demonstrated, and comparison is largely on the basis of variation in only one artifact category - the projectile point. This reconstructive deficiency is most critical for the early portions of the sequence where few excavated components exist for effective comparison and typological issues are not fully resolved. For example, no firmly associated Clovis Complex (including Folsom and Plainview) assemblages yet exist in Alberta; the dating and cultural relationships of various unstemmed lanceolate styles is unclear; and the terminal Early Prehistoric appears to be more complex than originally thought with the recognition of styles designated as Mount Albion (Gryba 1983) and other as yet unnamed transitional varieties (Ronaghan 1985).

Although on a better footing, even the Middle Prehistoric Period is not as well understood as suggested. Many of the constituent components in the mountains from which subphase characteristics have been distilled exhibit significant mixing of point styles from presumably distinct cultural groups. Unless these proportional mixes of point styles are considered definitive of the various mountain subphases, the possibility of significant mixing of other constituent subsystems should be given consideration. It appears obvious that component integrity is a major problem facing effective phase definitions for comparative purposes and for subsequent culture historical interpretation.

Having made these cautionary remarks, it should be noted that the model suggested is the only region-wide, dynamic and chronologically inclusive formulation produced to date in Alberta. By comparison to other regions, where the record is fragmentary and unsynthesized, it represents a considerable interpretive advance. If nothing else, it provides a number of hypothetical relationships which can be discarded or modified as new lines of evidence are explored or older formulations are more tightly defined.

GAPS, PROBLEMS AND FUTURE DIRECTIONS

The status of the extant data base is such that extensive assemblage reanalysis and/or recovery of significant new information would be required to either substantially modify existing frameworks or formulate new ones. Therefore, these summary remarks will be confined to the identification of existing knowledge gaps and pertinent research problems. As well, consideration will be given to lessons learned since the inception of archaeological inquiry in the region and to both existing and future directions for research.

As with many other regions in northern North America where archaeological studies are in their relative infancy, substantial gaps exist in our knowledge. The period between the early 1960s and the early 1970s can probably be termed the Academic Period. During this time, the first systematic research was conducted in the Eastern Slopes. Studies were frequently wide-ranging survey and/or excavation programmes, some of which combined research and conservation goals. Analysis of the collected data was generally associated with graduate research which afforded time for interpretive consideration. Resulting formulations generally focussed on the development of regional chronologies or analysis of site distributional information to derive man/land relationship models.

The subsequent period, from the mid-1970s to the present, saw a significant shift in the direction of archaeological investigations. It can be termed the Resource Management Period and is coincident with the establishment of the Alberta Historical Resources Act and its attendant protection requirements. Investigations, almost without exception, focussed on areas determined by dispersed development locations rather than by current research questions. Analyses highlighted provision of the basic data required for management decisions and, most importantly, were conducted under considerable time constraints, so that in-depth interpretations or comparisons were generally not possible. Nevertheless, significant advances in our understanding of archaeology of the region have been made during this period. The potential utility of much of the data collected in conservation projects has not fully been explored.

These developments, coupled with the character of the landscape and resources, define a series of information requirements, of both a specific and a more general nature which would improve regional archaeological interpretation. Knowledge gaps can be associated with specific weaknesses of the data base and appropriate research problems can be associated with issues of a more general methodological and theoretical nature.

KNOWLEDGE GAPS

SURVEY COVERAGE

Several major deficiencies can be identified in the existing site survey data for this region. Secondary and tertiary drainages, as well as numerous upland areas in the southern part of the region, still remain to be examined. Notable in this regard are the Castle River region between Waterton and the Crowsnest; the Porcupine Hills east of the front range; and the smaller tributary systems of the Highwood, Sheep and Elbow, especially in the foothills region. North of the Bow, lower courses of the major rivers, entire secondary and tertiary systems, and large areas of intervening uplands require systematic survey. There is a significant knowledge gap throughout the region concerning use of high elevations. Other land forms such as bedrock thrust formations can provide access to formations containing material suitable for stone tool manufacture. Although quarries have been identified in the region, the locations of sources for silicified siltstone, which is ubiquitous in the Bow and Red Deer valleys, and the black chert common along the North

Saskatchewan drainage, are specific questions requiring investigation. In a general sense, much remains to be learned about the numbers and distributions of sources for lithic material used during various periods. This question is considered to be important because the distributions of material from specific locations may have utility as chronological, trade or cultural boundary indicators.

The number of mountain passes, either leading over the Continental Divide or joining major drainages, which have been investigated is exceedingly low. Although use of these areas for inter- and intra-regional travel is definitely suggested, systematic examination would be required to fully assess the extent to which the region functioned either as a buffer or as a travel corridor between the major culture areas to the east and west.

The emerging pattern suggesting substantial use of lake shores and the margins of wetlands in the northern portion of the region is not well understood and requires further investigation. Differences between the north and south in this regard may provide significant information on intra-regional variations in adaptive strategies.

The use of other topographically limited features, such as caves and rockshelters, appears to have been minimal, but this has not been adequately demonstrated and systematic studies are warranted. A similar lack of use is suggested for more common features such as mountain slopes and isolated ridges. While not considered a pressing knowledge gap, some investigation of these areas would be of interest.

EXCAVATED COMPONENTS

Discussion here will identify only geographic areas from which excavated components are lacking as well as site types which are under-represented in terms of analytical samples. Significant research questions toward which additional excavations are necessary will be dealt with later.

In the northern part of the region, only seven site excavations of moderate scale have taken place. Of these only two relate to major valley systems. Since major valleys provide the best possibilities for deep burial and stratigraphic separation of archaeological materials in the area, this lack presents a major impediment to culture historical reconstruction in particular.

Excavations inside the mountain fronts north of the Bow basin are limited to the ongoing research being conducted by Pickard (this volume). While still at a preliminary stage, analysis suggests that our impressions - that the area represents an extension of the Boreal Forest adaptations characteristic of the adjacent foothills - may not be accurate. More in-depth study would be necessary to adequately assess the Pickard's suggestion that some assemblages inside the mountain fronts more closely resemble interior Plateau occupations.

Although sites have been identified in high elevation situations, no excavations of such sites have been conducted anywhere in the region. As a result, no analytical samples exist to assess the nature and dating of this adaptation. The single rock shelter excavation conducted in the region (Hall 1976) demonstrated the potential for recovery of stratified cultural deposits in such situations. Samples from productive rock shelters or caves may provide valuable chronological information, especially for the northern portion of the region.

Site samples available for interpretation of various subsistence aspects of Eastern Slopes adaptations show significant gaps as well. For example, kill sites have been excavated in the southern foothills (Forbis 1962; Reeves 1978a), but only one detailed faunal analysis has been reported (Smith and Reeves 1979). Inside the mountain fronts, two kill site assemblages from the Crowsnest have been excavated and analyzed (Driver 1978a; Kennedy et al. 1982). This far less than satisfactory situation is surpassed by the total lack of information on hunting behavior elsewhere in the region.

Although a few quarry sites exist, only one systematically excavated test sample has been obtained (Kennedy et al. 1986). Secondary processing sites, such as workshops, exist but also have not been sampled. Lack of information regarding lithic extraction and processing constitutes a sizeable knowledge gap.

Tipi ring site excavations have provided some largely unsynthesized data on habitation types for the southern foothills, but, with a single possible exception (McCullough and Fedirchuk 1983), no other samples are available. The possible structural remains dating from very early periods at the Vermilion Lakes site (Fedje, this volume) and the recorded existence of pit house sites on the upper Bow and Red Deer rivers provide exciting examples of the directions that future research may take.

ENVIRONMENTAL DATA

There is a vast number of ways that knowledge of the structure and dynamics of environmental systems can assist archaeological interpretation. Four aspects have particular implications for gaps in existing the data.

The timing and extent of Late Pleistocene glaciation remains a major question with respect to initial peopling of the area, as well as of the continent as a whole. Although there is much disagreement among geologists in this regard, the possible entry of man into continental America through an ice-free corridor along the foothills of the Rockies during the late Wisconsin (25,000-12,000 years B.P.) remains a viable concept.

The earliest dated archaeological site in the region occurs well inside the mountain front in Banff National Park and has a basal date of around 10,500 years ago (Fedje 1984, this volume). The existence of firmly dated earlier occupations in various more southerly parts of the continent suggests that much older sites may be present in the Eastern Slopes region. Of immediate relevance, then, is the question of where such sites might be located. The demonstrated lack of synchronicity between Cordilleran and Laurentide advances (e.g., Rutter 1981), coupled with a Late Wisconsin date on a pollen core from the southern portion of the region (Mott and Jackson 1982; Vance, this volume), suggests that large portions of the southern foothills and mountains were ice-free for much, if not all, of the Late Wisconsin. Wisconsin age archaeological sites in this area, should they be found, may be just as likely to relate to previously resident populations as to initial migrants.

Further north, the question is more ambiguous. Evidence for extensive coalescence of the two ice masses has been recorded (Rutter 1977; Stalker 1956), but the dating of these events is unknown. Whether coalescence preceded or prevented initial peopling of the continent is likewise unknown. Extensive geological fieldwork and radiocarbon dating are required to clarify the question. Nevertheless, a great potential exists in the Eastern Slopes region of Alberta for discoveries of significance to the prehistory of the entire New World.

Possibly one of the greatest forms of assistance geology can provide to archaeological investigation of these questions is the identification of areas within the presumed ice-free corridor which may not have been affected by Wisconsin glaciation. If Cordilleran advances in the area were actually characterized by constricted valley ice tongues, large intervening areas of non-glaciated terrain should have existed, resulting in the preservation of Wisconsin age sites. The Porcupine Hills in the foothills north of the Oldman basin is one such area, but others undoubtedly exist. The habitability of such areas at this time, however, may have been as much an impediment to occupation as ice positions. Until positive evidence is obtained, use of the ice-free corridor for human migration into the continent remains only speculation.

The second major area in which environmental information can be of concrete assistance to the archaeologist involves the understanding of post-glacial depositional patterns. The visibility of archaeological sites in the region has undoubtedly been greatly affected by locale-specific depositional and, to a lesser extent, erosional sequences. Wilson's article in this volume demonstrates how geoarchaeological information can be used to predict the potential locations of deeply buried sites along major valley systems in the southern foothills. The closer one approaches the mountains, the more complex the sequences are likely to be, reflecting a variety of alluvial, colluvial and aeolian processes controlled, in large part, by local topography.

The issue of site visibility is of great significance throughout the region. It is suspected that a large portion of the Early Prehistoric occupation of the area lies in deeply buried contexts. Greater understanding of general principles of land form development would undoubtedly result in improved rates of site discovery in various portions of the region and would provide a major key toward the eventual resolution of a large number of chronological and behavioral questions. The recognition of suitable locations for potentially deeply buried sites and possible stratification of cultural deposits is critical for the northern portion of the region.

Because human adaptations to the Eastern Slopes were structured to a great degree by vertical variation in seasonally available resources, a third area in which environmental data can serve to improve interpretation is through greater understanding of elevational variation in vegetation zones throughout the Holocene. The effects of climatic changes, such as those postulated during the proposed Altithermal and Neoglacial periods, would have probably been most dramatic along the slopes of the Rockies where vegetation zones are stacked in close proximity. Changing adaptive strategies reflecting vegetation and resource distribution changes may be recognizable with greater understanding of the nature and extent of such changes. Recovery and analysis of a series of pollen cores from a variety of areas and elevations would be necessary to provide such data.

Finally, a major problem for interpretation in forested areas throughout the region is the almost universally poor preservation of organic remains in archaeological sites. The generally acidic nature of the soils in these regions is the prime reason for this, although different soils do exist which may have varying effects on organic remains. A more complete understanding of these effects may greatly improve archaeological interpretation. For example, systematic observations of differential element preservation under varying pH levels may provide some indication of the original character of faunal assemblages at archaeological sites. Chemical analysis in general may hold great potential for interpretation of cultural activities at sites in a variety of preservation conditions. These problems are more methodological in nature and not specific to the region.

RESEARCH PROBLEMS

METHODOLOGICAL ISSUES

The effects of the shift in the focus of archaeological investigations during the Resource Management Period are numerous and ongoing. One of the major differences from the earlier Academic Period has been the dispersed and disconnected nature of the studies. This has resulted in considerable numbers of analyzed assemblages but little in the way of systematic synthesis. A major problem for research in the area, then, is the development of means by which effective comparison can be conducted over wide areas.

Comparison is only possible between well-defined and universally recognized analytical units. Several areas of concern can be identified in this respect. Projectile point typology is largely still an art in Alberta archaeology. With the exception of the most recent period (Forbis 1962), the range of metric and non-metric parameters which define a type recognized in Alberta have not been universally established. It is easy to see disagreements arising as different researchers classify various regional styles.

A similar difficulty is present in other aspects of the analysis of lithic assemblages. There is a definite need for concensus in the identification of lithic material types. For example, one person's Knife River Flint may be another person's brown chalcedony. The differences in the interpretive implications of such identifications are significant, bearing on issues of trade, cultural contact and, perhaps, ethnicity. The distribution of various lithic source materials may eventually be recognized as an important chronological indicator as well. Standardization of criteria for identification of lithic materials (especially imported varieties) and sources in the area would greatly assist assemblage comparison.

Lithic analyses frequently employ different terminology in the description of what appear to be functionally equivalent items. For instance, are one analyst's wedges the same as another's pièces esquillées, or are concave edged flake tools the equivalent of spokeshaves? There are similar problems in the use of inconsistent terminology to describe the various products of lithic reduction sequences. Standard comparative categories would undoubtedly improve our ability to formulate concepts of intra-regional assemblage variation and, as a result, generate hypotheses with chronological or behavioral implications. The resolution of these issues will not be easy and would require both the cooperation and participation of most Alberta researchers.

Roughly similar problems exist with regard to faunal analysis. Driver's (1982) call for minimum standards for faunal analysis has been largely ignored, at least in the case of smaller projects. While the situation is improving, it is still far from ideal. Implementation of a standard set of analytic criteria for faunal remains faces fewer difficulties, however, than is the case with lithics.

Faunal remains in archaeological sites are the most commonly used data for making inferences relating to subsistence and seasonality of occupation. The establishment of systematic criteria for analysis should provide the basic information needed to identify subsistence strategies especially when viewed at a regional scale. The preservation of evidence for the use of vegetable products is much more doubtful and would likely require more indirect reasoning. Confident inference of seasonality of occupation is a similarly difficult issue. Current techniques involving ungulate tooth eruption and wear schedules (e.g., Frison and Reher 1970) and the presence of foetal remains are imprecise. The development of superior techniques for determining season of occupation is a major problem for future research.

Another concern with regard to comparison of analytical units relates to the larger scale of phases and subphases. Reeves' (1983) dissertation research provides an example of how detailed phase descriptions allow comparison over extensive geographical areas. However, such phase descriptions are limited to a small portion of the entire time scale in Alberta. There is a decided need for extension of this procedure to cover other time periods. Without such information, effective intraregional comparisons cannot be made, and useful cultural implications will be exceedingly difficult to draw. In many areas, we do not possess the necessary discrete assemblages to permit comparison, but this situation need not be considered a permanent one.

The final methodological issues raised here are the problems involved in dating assemblages from sites which ostensibly lack organic remains and the ability to discriminate discrete chronologically sequent assemblages from sites with badly compressed stratigraphy. These problems are not limited to the Eastern Slopes and may never be resolved with current techniques. Nevertheless, both problems are undoubtedly the most critical impediments to the development of adequate chronologies in areas where these are lacking and to firm definition of settlement patterns throughout the region. With the exception of new finds, no solution can be offered at this point to resolve these questions. Major new lines of research will likely be required in order to deal with this problem at sites currently on record.

CULTURE HISTORY

Firm understanding of the chronological sequences characteristic of the region must be the basis for investigation of issues of culture process. While significant strides have been made in the Oldman and Bow basins, a number of major problems still exist. As we have seen, the Eastern Slopes region of Alberta has perhaps the greatest potential of any area in the country for the occurrence of pre-fluted point occupations. No firm evidence has yet been recovered, but the question of the earliest Americans may eventually be resolved in this region.

Fluted points have been recovered in surface contexts in various parts of the region and two have been excavated in the Bow basin (Gryba 1983). Unfortunately, no assemblages or dates can be firmly associated with these finds. Although a discrete component dated around 10,500 years B.P. from the Vermilion Lakes site (Fedje, this volume) falls close to the expected time range for a fluted point occupation (see also Fladmark et al. 1984), no diagnostic artifacts have been recovered to suggest stylistic or cultural relationships.

Most fluted points recovered in Alberta are much shorter in length and have less well developed (or multiple) channel flake scars than the classic specimens from the south (Gryba 1985). Whether this represents chronological or cultural differences or simply greater levels of curation and reuse cannot be evaluated at the present time. The distribution, dating and nature of fluted point occupations is an important problem for future study.

Although some fairly significant problems exist in the resolution of the component subphases, an inclusive chronology has been developed for the southern portion of the region. Inside the mountain fronts, Early Prehistoric occupations are reasonably well represented, but the foothills zone is lacking in this regard. The situation north of the Bow basin is considerably different. Although some relationships to the southern sequence have been drawn, no chronology or phase relationships have been defined. Culture historical sequences in the north, therefore, constitute perhaps the major research problem in the region.

The journals of the early traders and explorers provide some indications of the ethnicity of the occupants of the region from at least the late eighteenth century. Comparison of these accounts with the material aspects of contemporary assemblages and linking the results to Late Prehistoric assemblages may be a fruitful avenue for research (see Forbis 1963). Recognition of the distinctive material correlates associated with proto-historic Kutenai, Sarsi or Sekani/Beaver occupations, if this can be demonstrated, may eventually lead to resolution of questions of prehistoric ethnicity.

Adaptations

Unlike many areas of the interior plain, mountain environments exhibit a rigid seasonal structuring of available resources conditioned by a variety of factors, in particular, topography. Human adaptations to such environments must also be highly structured. Several projected seasonal patterns of movement and exploitation have been suggested for the Oldman basin. The reliability of these patterns rests on a number of basic data requirements. Site samples must be available from a wide variety of topographic locations within projected exploitation areas. Site assessment must be sufficiently detailed to permit confidence in inferring site function. Subsistence and seasonality must be established on the basis of systematic analysis and reliable techniques. Finally, good dating controls must be present.

Some aspects of the southern patterns do not fulfill these requirements and, as a result, may require more analysis for confirmation or modification. Elsewhere in the region, insufficient subregional samples exist to permit firm definition of seasonal settlement pattern models for comparison with those suggested for the Crowsnest and Waterton. Although coordinated, long-term research programmes will be necessary to resolve this problem, there would be many benefits of such research. Coupled with reliable dating of occupations, issues of culture process in this largely unknown area may then be approached with such data.

It is very difficult to define ethnicity on the basis of material culture which typically lacks stylistic variation or contains stylistic variation deeply embedded in largely functional parameters. However, the issue has been raised with regard to linking ethnographically recognized groups with their immediate prehistoric predecessors. The problem can also be viewed on the broader scale of time ranges represented by the entire Prehistoric Period, that is, whether analytical units such as phases (subphases in Reeves [1983] terminology) actually represent distinct sociologically and culturally linked populations. This problem goes well beyond regional concerns but has specific bearing on whether significant cultural differences existed within the region through time, and whether the region differed significantly from adjacent culture areas. Resolution of these questions are currently beyond the means of the data on a large scale.

One of the best currently available means of drawing inferences about external group relationships is the distribution of non-local cultural materials, which suggests some sort of exchange network or cultural contact. Where sample sizes are large enough, such as along the Oldman drainage, exotic materials - primarily lithics - form a considerable proportion of excavated and collected samples. Temporal variation in the origin and distribution of certain lithic types has been used to support various models of culture change (Loveseth 1980; Reeves 1983). Although some problems exist with respect to component integrity and some refining is necessary, quantitative comparisons are now possible for both subregions and time periods. Patterning does appear to exist and, if confirmed by further research, can be used as a tool for intraregional comparisons.

North of the Oldman Basin, insufficient numbers of excavated components exist in order to draw wide ranging conclusions about temporal variation in imported materials. Nevertheless, evidence suggests that rather distant exchange networks were in place at various times in prehistory. At present, it appears that non-local materials represent much lower proportions of assemblages than is the case further south. This may, however, only represent a lack of knowledge regarding different sources for the ubiquitous quartzites and pebble cherts.

If the distribution of exotic materials holds considerable potential for determining external relationships, the distribution of local materials hold as much potential for determining internal relationships. For effective comparison, samples must have good chronological control and must be relatively discrete. With certain reservations, adequate samples to conduct such comparisons currently exist for the southern half of the region. Lack of adequate assemblage dating presently restricts the utility of northern samples for such comparison.

LESSONS LEARNED

The shift away from synthesis, during the Resource Management Period, has resulted in the accumulation of information at rather low, more phenomenological levels. The basic lessons learned about the character of the archaeological record during the Academic Period have been augmented primarily by improved understanding of site visibility and distribution, and of the characteristics of the northern data base.

Improved site discovery rates resulting from the institution of required subsurface testing has demonstrated that most of the early studies are inadequate for management purposes and that substantive new information likely remains to be obtained. Shovel pit testing has proven to be the most effective discovery tool in forested areas and can substantially improve returns in grassland areas. Perhaps at least as important in terms of site visibility has been the recognition of the high levels of deposition characteristic of various parts of the region. The use of mechanical devices such as power augers and backhoes in specific sediment traps or on other rapidly accumulating surfaces has proven to be quite productive in terms of finding deeply buried archaeological materials. In a similar but less direct manner, monitoring of deep man-made exposures resulting from a wide variety of development projects is also frequently instructive, both in terms of discovery of deeply buried sites and recognition of natural depositional sequences. It is becoming apparent that many significant sites in the region remain to be identified and investigated even in previously surveyed areas. The potential for discovery of stratified, deeply buried sites provides perhaps the best opportunity for resolution of existing problems.

Advances in our understanding of site distributions have occurred throughout the region but primarily in the north, where several upland areas outside main valleys have been extremely productive of prehistoric sites. Excavations undertaken at northern sites have revealed some of their characteristics and provided a view of resident material culture but have not yet resulted in detailed chronological sequences or behavioral interpretations.

Perhaps the most important lessons learned have been within the management system itself. The demonstrated wide dispersal of sites throughout the region and elsewhere within the province has highlighted the necessity of appropriate management strategies in order to avoid large scale losses. Similarly, the dispersed and disconnected nature of the studies demands that effective comparison take place. Burley (1985) has argued that formulation of coordinated research designs will go far toward the solution of existing problems. That view is generally supported here, but it has been argued that much lower level research is also necessary for effective comparison. One of the greatest needs is concensus among Alberta researchers as to pressing research requirements. It is through the specification of regional research goals, design of appropriate studies, and systematic collection of comparable information that important interpretive strides will be made.

FUTURE RESEARCH

Although considerably diminished over earlier periods, archaeological research is continuing in the Eastern Slopes of Alberta. Graduate students at both the universities of Alberta and Calgary are presently analyzing prehistoric data from the area as part of thesis research (Landalls, Rollans, personal communications 1986). Two doctoral candidates will also incorporate historical data from the region in their dissertations (Kennedy, Langley, personal communications 1986). While much of the ongoing work by Parks Canada Archaeological Research Unit relates to impact assessment and mitigation, some broader scale studies such as inventories are being conducted (Pickard personal communication 1986). Of course, further CRM studies will take place, and some will likely be of substantial size. It is hoped that the results of this work will be useful in terms of problem resolution.

There is considerable potential for productive archaeological research in the Eastern Slopes of Alberta. As has been noted, many of the material analyses to date have been at simple descriptive levels. These materials are either stored at the Provincial Museum, Archaeological Survey of Alberta or the two major universities. Analysis of these materials with specific research problems in mind holds considerable promise for solution of some of the more critical problems discussed earlier.

Although many of the areas in the region considered to have the highest potential for the occurrence of prehistoric sites have been surveyed, substantial potential for significant new finds exists, especially in deeply buried contexts. Large areas exist which have never been examined.

Large numbers of significant or potentially significant sites have been recorded but have never received detailed examination. Consequently, there exists a great potential for the recovery of analytical samples which may have bearing on a great variety of research questions. Such sites are, however, finite resources and future examinations at sites not threatened by immediate impact will require well developed and relevant research designs.

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NORTHERN ROCKY MOUNTAINS ARCHAEOLOGY
A BIBLIOGRAPHY

By
Brian O. K. Reeves

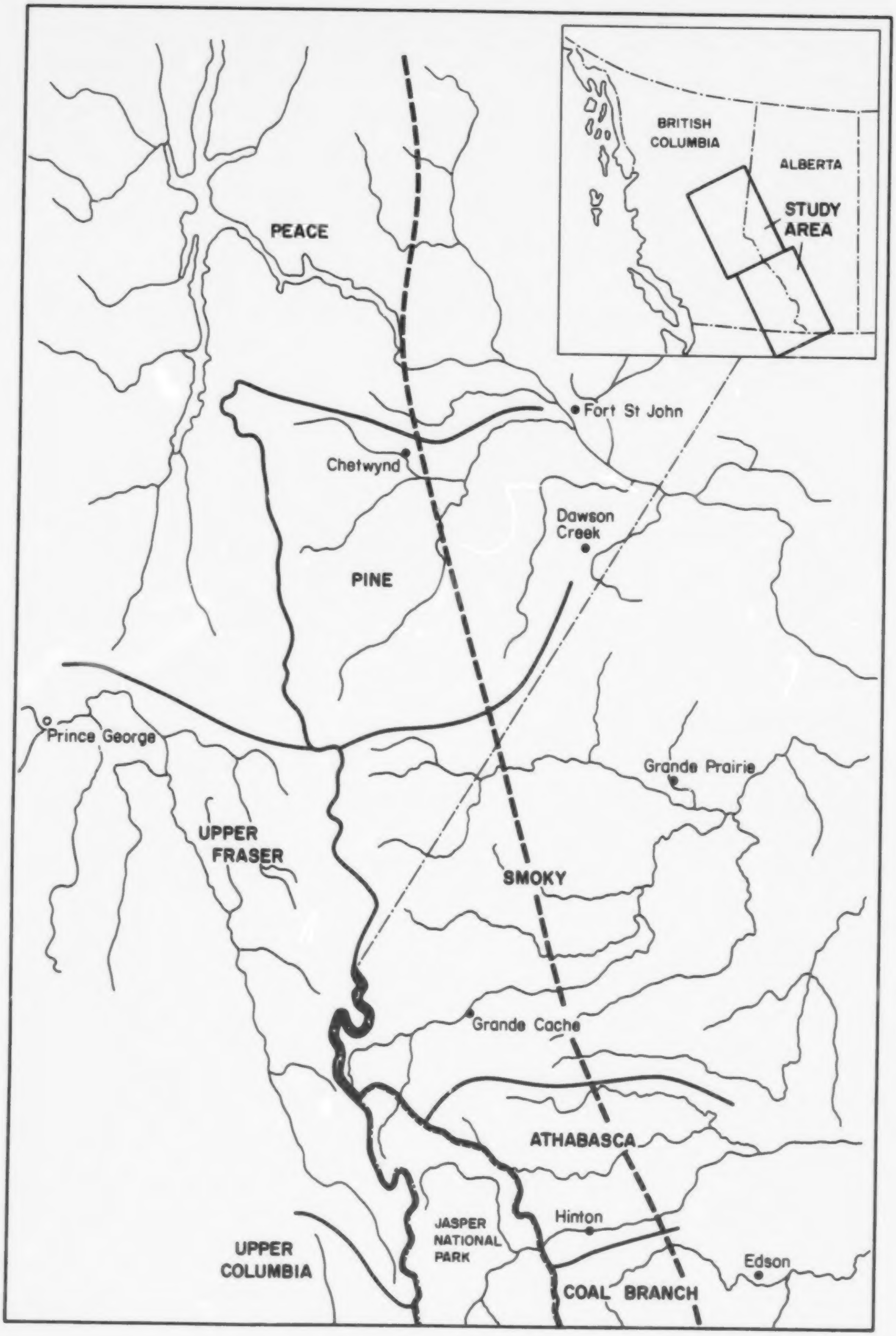
INTRODUCTION

Archaeological studies in the Canadian Rocky Mountains have been conducted principally in support of various development projects. These studies have resulted in the production of a large number of limited circulation reports for private corporations and provincial or federal agencies. The reports contain a substantive body of information of interest to students of Rocky Mountain archaeology. My objective in preparing the following bibliography is to provide a single reference source for all written materials (exclusive of newspaper articles) on the archaeology of various regions of the Canadian Rockies.

THE NORTHERN ROCKY MOUNTAINS

The study area comprises the southern and middle Canadian sections of the northern Rocky Mountains from the United States border north to the Peace River (Figure 101). I define the study area geologically. It includes the foothills, Rocky Mountains (front, eastern, main and western ranges) and the Rocky Mountain trench.

Although geologically unified, the ecosystems of these regions vary latitudinally and altitudinally. As a result, some of the prehistoric archaeology, in terms of both culture and land use histories, is similar to that in the adjacent Plains, Cordillera and Plateau. Sites in the southern foothills of Alberta (e.g., Late Prehistoric sites) are winter bison hunting sites (Perry 1974; Quigg 1974) and as such are part of the plains-foothills settlement pattern rather than foothills-mountain pattern. In contrast, in earlier times these sites were part of a broader settlement system which encompassed the Rockies as well. Sites in the Pine River basin in northeastern British Columbia (e.g., Kennedy and Reeves 1982) are spring/fall hunting camps associated with a pattern


BRITISH COLUMBIA
ALBERTA
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PEACE
Fort St John
Chetwynd
Dawson Creek
PINE
Prince George
Grande Prairie
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SMOKY
Grande Cache
ATHABASCA
JASPER NATIONAL PARK
Hinton
UPPER COLUMBIA
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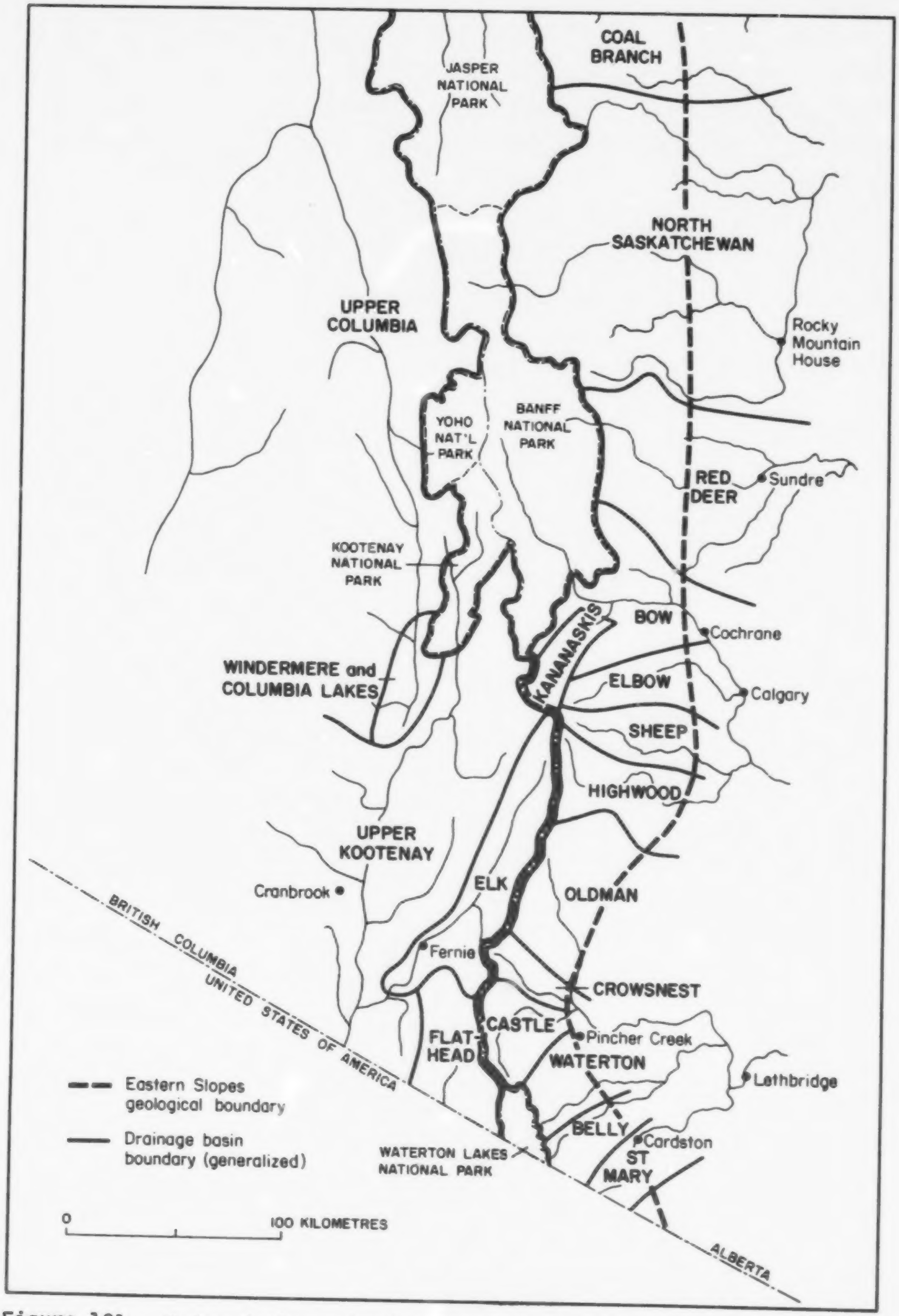
COAL BRANCH
JASPER NATIONAL PARK
NORTH SASKATCHEWAN
UPPER COLUMBIA
Rocky Mountain House
YOHO NAT'L PARK
BANFF NATIONAL PARK
RED DEER
Sundre
KOOTENAY NATIONAL PARK
KANANASKIS
BOW
Cochrane
WINDERMERE and COLUMBIA LAKES
ELBOW
Calgary
SHEEP
HIGHWOOD
UPPER KOOTENAY
Cranbrook
ELK
OLDMAN
Fernie
BRITISH COLUMBIA
UNITED STATES OF AMERICA
CROWSNEST
CASTLE
Pincher Creek
FLATHEAD
WATERTON
Lethbridge
Eastern Slopes geological boundary
Drainage basin boundary (generalized)
BELLY
Cardston
WATERTON LAKES NATIONAL PARK
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Figure 101. Major drainage basins along the Eastern Slopes.

involving wintering further east in the Peace River lowlands. The Rockies are neither a cultural isolate nor an extension of the Plains or Plateau culture areas (McCullough and Fedirchuk 1983). Rather, the mountains form a discrete cultural area which, at times, is culturally separate from but, at other times, is part of the extension of the cultures of the Plains, Plateau and Boreal Forest (Reeves 1978d).

Of course, researchers who are interested in studying the archaeology in the "boundary zones" must consult other sources and bibliographies for sites which lie outside the geologically defined borders used herein. I would also note that the eastern border lies west of that used by the Archaeological Survey of Alberta to define the Eastern Slopes development review area. Their definition includes portions of the western plains incorporating the Porcupine Hills; however, these hills are erosional peneplain remnants and structurally not part of the Eastern Slopes.

INTERNAL SUBDIVISIONS: RIVER BASINS AND NATIONAL PARKS

Although the bibliography is alphabetically ordered by author, I have provided a tabular listing (Table 38) organized by river basins and national parks. The river basins range from rivers of major rank (e.g., the Kootenay) to smaller tributaries (e.g., the Sheep River, a tributary of the Bow). The selection of basins for this table was based in part on ecology but primarily on the number of archaeological studies associated with a particular basin. If there have been a relatively large number of studies, including major excavation reports, as is the case for the Sheep River, for example, I felt it useful to separate it from the Highwood, an adjacent tributary on which a number of studies have also been done. In other cases, where only a few studies have been reported for a much larger basin, the Kootenay for example, I felt it of little value to separate out tributary rivers other than the Elk, even though some, like the White (Brown and Lundberg 1976), have had minor archaeological surveys done.

Although my listing by river basins is a search convenience, it is a useful way to organize our thinking and analysis of Rocky Mountain prehistory since, because of the basins' varying biophysical characteristics, they did influence both native cultural and land use histories (McCullough and Fedirchuk 1983; Reeves 1975, 1978d). In those valleys where sufficient excavations have been done to reconstruct the cultural history, such as Waterton (Reeves 1972) and Crowsnest (Driver 1978; Kennedy et al. 1982), there are recognizable differences in the sequences between adjacent valley systems. By operating at the river basin level, we can develop local cultural sequences and subphases within the larger regional context (e.g., Driver 1978; Reeves 1972) which conform to established conventions for development and use of spatial, temporal and archaeological units. They are not, as some workers have implied (e.g., McCullough and Fedirchuk 1983), simple conveniences.

Some reports, such as the various pipeline studies (McFee 1979; Reeves 1976a) along the Eastern Slopes, cover more than one drainage basin. These studies have been cited for all basins that they transverse. Other studies which involved projects including different areas of the Rockies reported on within a single report, for example, highways (e.g., Heitzmann and Priegert 1979) or forest campground, also have multiple citations.

FORMAT AND CONVENTIONS

The format I use for bibliographic citations includes certain kinds of information which may not be in the title of the report or publication. Most reports are unpublished documents located in various repositories. Inclusion of these data will, I hope, assist the user. All citations are given by author; in the case of those reports with the company cited as author on the title page, the report's credit page generally lists the author. I have simply listed each author's reports within the same year in the order in which they were completed within that year.

I have also included, where applicable, the permit numbers under which the reports were prepared for land under provincial jurisdiction in Alberta and British Columbia. In the case of the consultants' reports, I have also noted the consultant company through which the report was done and the client for whom it was prepared. The locations of file paper copies of the report and where one may obtain a copy are also noted. These are generally either provincial or federal governments agencies, or the consultant, researcher or contractor who did the study. Many corporate clients also have copies in their libraries; however, often these reports are difficult to locate for outside users or may no longer exist.

Where possible, I differentiate categories of reports in terms of "in-house" versus "out-house" reports. Consultants' Reports are those prepared by private sector, independent archaeologists under consultant/client relationships with private or public agencies. Contract Reports are those prepared for public or private agencies by either individuals under wage contracts with that agency (e.g., Archer 1971) or individuals contracted to that agency for the study being reported on (e.g., Ball 1976). Research Reports are those done by either public or private sector archaeologists which may be the result of unfunded or funded research through private, provincial or federal granting agencies. Permit Reports are those submitted to fulfill permit requirements; they do not necessarily relate to research reports. Staff Reports are internal provincial or federal agency reports fulfilling agency objectives and needs rather than an individual's own interests. Student Reports refer to those done in fulfillment of various course requirements.

The bibliographic entries demonstrate the large number of studies which have been done by archaeologists in the Rocky Mountains, particularly over the past twenty years. Although varying in content, they constitute a substantive body of information awaiting detailed study and synthesis. To date, no synthesis has been done except for brief reviews by myself on the culture history and status of the resource (Reeves 1973b, 1975j, 1978d, 1981b), and some other primarily localized considerations (Choquette 1982; Driver 1978; Kennedy et al. 1982; Reeves 1979b). When one is undertaken, it will certainly result in a better understanding of the region's culture and land use history than is currently available in the pioneering studies noted above.

Table 38. Archaeological report listing by study area.

Athabasca

Ball 1983a
Brink 1979d
Brink 1980a
Bryan 1978
Damp and Reeves 1981
Losey 1981a
Losey 1981b
Losey 1981c
Pollock 1981a
Pollock 1982a
Pollock 1982b
Pollock 1982c
Reeves 1972a
Reeves 1973a
Reeves 1974a

Banff National Park

Christensen 1970
Christensen 1971a
Christensen 1971b
Damp and Connolly 1980
Fedje 1982
Fedje 1984
Fedje and White 1984
Fedje et al. 1985
Head 1983b
Head and Porter 1983
McIntyre and Reeves 1975
Poole 1977
Poole and Anderson 1975
Porter 1979a
Porter 1979b
Porter 1980
Reeves 1972b
Reeves 1973d
Reeves 1974b
Reeves 1976c
Sanson 1924
Smith 1914
Steer and Fedje 1982
Steer and Porter 1981a
Steer and Porter 1981b
Steer and Porter 1981c
Steer and Porter 1982a
Steer and Porter 1982b
Southwood 1979
Sumpter 1985a

Castle/Carbondale

Gryba 1980b
Heitzmann and Priegert 1979a
Heitzmann and Priegert 1979b
McCullough and Reeves 1978a
Quigg 1980
Quigg 1981

Coal Branch (Embrass and MacLeod R)

Balcom 1982a
Balcom 1982b
Balcom 1983b
Brink 1974
Brink 1979c
Brink 1980a
Brink 1983a
Calder and Reeves 1977
Calder and Reeves 1978
Hall 1976
Hunt 1981a
Hunt 1981c
Hunt 1982
McCullough 1982a
McCullough 1982b
McCullough and Reeves 1976
McCullough and Reeves 1977
Newton 1982
Reeves 1972a
Reeves 1973a
Reeves 1975k
Reeves 1976b
Reeves 1976d
Reeves 1978b
Reeves 1978e
Reeves 1980d
Ronaghan 1981
Ronaghan 1982a
Ronaghan 1982b
Ronaghan and Reeves 1981
Steer 1981
Wilson 1977a
Wilson 1977b
Wilson 1977d
Wilson 1978a
Wilson 1980d
Wood 1979

Table 38 continued

Crowsnest

Apland and Wright 1979
Burns 1975
Burns 1984
Calder, E.M. et al. 1976
Calder, E.M. et al. 1978
Calder, J.M. et al. 1977
Connolly and Gee 1975
Dingle 1981
Driver 1976
Driver 1978
Driver 1982
Driver 1983
Driver and Loveseth 1977
Duke 1978
Forsman 1980a
Forsman 1980b
Forsman 1982
Graspointner 1978
Graspointner et al. 1978
Hackler 1974
Heitzmann and Priegert 1979a
Heitzmann and Priegert 1979b
Hunt 1983
Kennedy 1979
Kennedy 1982
Kennedy 1984
Kennedy and Smith 1983
Kennedy and Loveseth 1984
Loveseth 1976a
Loveseth 1976b
Loveseth 1980
McFee 1979a
McFee 1979b
Pickard 1981
Poole 1976a
Poole and Reeves 1975
Quigg 1975a
Quigg and Reeves 1975
Reeves 1972a
Reeves 1973a
Reeves 1974c
Reeves 1974d
Reeves 1974e
Reeves 1975a
Reeves 1975b
Reeves 1975c
Reeves 1975d
Reeves 1975e
Reeves 1976e
Reeves 1976f
Reeves 1976g
Reeves 1977d
Reeves 1977e
Reeves 1978a
Reeves 1978c
Reeves 1979b
Reeves 1984a
Reeves 1984b
Reeves and Driver 1978
Reeves and Kennedy 1980
Ronaghan 1980
Ronaghan 1985
Smith 1977
Wood 1984
Wright 1979
Wright and Lobay 1978

Elbow

Forbis and Rogers 1973
Heitzmann and Priegert 1979a
Heitzmann and Priegert 1979b
McCullough and Wilson 1980a
McCullough and Wilson 1980b
McCullough and Reeves 1978a
McCullough and Fedirchuk 1983
McFee 1979a
Poole and Reeves 1975
Quigg 1980
Quigg 1981
Quigg 1982
Reeves 1973a
Rogers 1974
Rogers 1975
Wilson 1980e
Wright 1979

Elk

Brulotte 1980
Cassidy 1984
Choquette 1973a
Choquette 1973c
Choquette 1973d
Choquette 1976b
Choquette 1976c

Table 38 continued

Elk

Choquette 1979
Choquette 1983b
Kennedy et al. 1982
Loveseth et al. 1979
Reeves and Choquette 1977
Reeves and Head 1976
Ronaghan et al. 1982
Warner 1982
Wilson 1980a
Wilson 1980b
Wilson 1982a
Wilson 1982b
Wood 1980b

Flathead

Apland 1979
Foster 1978
Foster and Brolly 1978
Wilson 1981a

Highwood

Apland and Wright 1979
Brink 1978
Brink 1979a
Brink 1979e
Brink 1980b
Brink 1981
Brink 1983b
Fowler 1950
Gryba 1980b
Gryba 1983b
Heitzmann and Priegert 1979a
Heitzmann and Priegert 1979b
Keyser 1978
Leechman et al. 1955
McCullough and Reeves 1976
McCullough and Reeves 1977
McCullough and Reeves 1978a
McFee 1979a
Minni 1979
Poole 1976b
Poole and Reeves 1975
Quigg 1982
Reeves 1973a
Reeves 1976a

Highwood

Rogers 1974
Rogers 1975
Wilson, M.C. 1977

Jasper National Park

Anderson and Reeves 1975
Elliott 1970-71
Pickard 1984a
Head 1983a
Pickard 1984b
Pickard 1984c
Reeves 1979a
Sumpter et al. 1985

Kananaskis

Balcom et al. 1984
Brink 1979b
Brink 1980a
Brink 1980c
Brumley 1984
Finnigan 1978
Finnigan and Brumley 1978
Head 1977
Heitzmann and Priegert 1979a
Heitzmann and Priegert 1979b
McCullough and Wilson 1980a
McCullough and Wilson 1980b
McFee 1978
Pollock 1981b
Pollock 1982c
Reeves 1972a
Reeves 1972c
Reeves 1973e
Reeves 1973g
Reeves 1974a
Reeves 1975h
Reeves 1975i
Reeves and Murray 1973
Rogers 1974
Rogers 1975
Warner 1979
Wilson 1977c
Wilson 1978b
Wilson 1978c
Wilson 1979a

Table 38 continued

Kananaskis

Wilson 1979c

Kootenay and Yoho National Parks

Loy 1971
Mitchell 1972
Mitchell and Choquette 1973a
Mitchell and Choquette 1973b

North Saskatchewan

Brink 1981
Bryan 1975
Calder 1977
Calder 1978
Heitzmann 1981
Reeves 1972a
Reeves 1973a
Reeves 1973f
Reeves 1974a
Reeves 1977c
Reeves 1980b
Reeves n.d.
Ronaghan 1981
Van Dyke 1983

Oldman

Apland 1981a
Apland and Wright 1979
Balcom 1984
Brulotte 1981
Brulotte 1983a
Brulotte 1983b
Burns 1984
Finnigan 1978
Finnigan and Brumley 1978
Forbis 1966
Heitzmann et al. 1981
McCullough and Reeves 1978a
McFee 1979a
McFee 1979b
Reeves 1972a
Reeves 1973a
Reeves and Dormaar 1972
Wilson 1980c

Oldman

Wilson 1980f
Wright 1979
Wormington and Forbis 1965

Peace

Bussey 1982
Fedje 1977
McGee 1963
Mitchell 1964
Wilson 1979b

Pine

Apland 1981b
Ball 1976
Ball 1977
Ball 1978
Ball 1980a
Blacklaws 1981
Bussey 1981a
Bussey 1981b
Kennedy and Reeves 1982
Magne 1982
Poplin and Reeves 1982
Reeves 1977b
Reeves 1980c
Reeves 1981a
Reeves 1981c
Stryd 1982

Red Deer

Brink 1980a
Brink 1983a
Elliott 1970-71
Fedirchuk 1983
Gryba 1980a
Gryba 1980e
Head 1980
Pollock 1984
Reeves 1972a
Reeves 1972b
Reeves 1973a
Reeves 1974a
Reeves and Head 1979

Table 38 continued

Saint Mary

Anderson and Poole 1976
Poole and Anderson 1976
Quigg 1974b
Quigg 1975a
Perry 1974

Sheep

Apland and Wright 1979
Brink 1980a
Brink 1983a
Forbis and Rogers 1973
Gryba 1982
Heitzmann et al. 1981
Heitzmann and Newton 1982
McCullough and Fedirchuk 1983
McFee 1979a
Reeves 1973a
Reeves 1976a

Smoky River

Brink 1974
Brink 1975
Brink 1979e
Brink 1980a
Brink 1980b
Brink 1983a
Buchner 1978a
Buchner 1978b
Buchner 1979
Buchner 1982
Fedirchuk 1981
Gryba 1981b
Gryba 1983a
Heitzmann and Fedirchuk 1983
Reeves 1975g
Slater 1977
Slater 1978
Wilson 1980f
Wilson 1981d

Upper Columbia

Mitchell 1969

Upper Fraser

Cassidy 1976
Cassidy 1979
Weddie 1971
Wilson 1981b

Upper Kootenay

Archer 1971
Blake 1975
Blake 1981
Borden 1956
Bussey 1977
Brown and Lundberg 1976
Choquette 1971b
Choquette 1971c
Choquette 1973b
Choquette 1973d
Choquette 1974a
Choquette 1974b
Choquette 1974c
Choquette 1975
Choquette 1976d
Choquette 1977a
Choquette 1977b
Choquette 1977c

Choquette 1981
Choquette 1982
Choquette 1983a
Crosier 1973
Pike 1973
Reeves and Head 1976
Turnbull 1968
Whitlam 1974
Whitlam 1976
Wood 1980b

Waterton

Elliott 1978
Milne Brumley 1971a
Milne Brumley 1971b
Reeves 1964
Reeves 1965
Reeves 1967
Reeves 1968a
Reeves 1968b

Table 38 continued

Waterton

Reeves 1969a
Reeves 1969b
Reeves 1970
Reeves 1971a
Reeves 1971b
Reeves 1972d
Reeves 1975f
Reeves 1978a
Reeves 1980a
Reeves 1981d
Reeves 1985
Reeves and Steinhauser 1980
Simonds 1973
Sumpter 1985b
Sumpter et al. 1985

Windermere & Columbia Lakes

Borden 1956
Choquette 1971a
Duff and Borden 1953
McKenzie 1976a
McKenzie 1976b
Mohs 1981
Sneed 1981
Wilson 1979d
Wilson 1981c
Yip 1982

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